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THE USE OF

SCLEROSING SOLUTIONS IN THE TREATMENT OF CYSTS AND FISTULAE*

ELLIOTT C. CUTLER, M.D. AND ROBERT ZOLLINGER, M.D.

BOSTON, MASS.

OUR experience with the use of sclerosing solutions in the treatment of cysts and fistulae has encouraged us to write these notes, with the hope that surgeons may from time to time be willing to lay aside the knife for a method which may cause much less destruction of tissues, much less suffering for the patient, and a much shorter convalescence, or even a convalescence during which the patient may be ambulatory.

Every change in the practice of surgery has aroused violent opposition. The battle between Lister and his opponents is too fresh in our minds for this point to need emphasis. Even the introduction of the *x*-ray elicited bitter criticism on the part of the conservative practitioners of surgery of that day. More recently the introduction of the electric scalpel and of the many forms of electricity both for cutting and for coagulation has brought bitter opposition and slow acceptance. These notes, however, do not suggest a new method, but merely attempt to enlarge the use of a physical method of therapy practiced for many centuries.

Chemicals,[1] arsenicals or in more primitive form copper "flakes," perhaps were first used as powerful sclerosing salves in the treatment of superficial cancer, fistulae and even hemorrhoids, a method continued by quacks up to the present time. In more recent times fistulae in the neck were actually treated by irrigation with cauterizing fluids almost exactly in the same manner as in one of our cases to be described later. Dzondi[1] wrote in 1829 concerning a woman of twenty-eight years whom he had seen in 1821 with a fistula in the neck one inch to the left of the midline. He states that "after various caustics had been tried to no purpose, the fistula was at last healed by injecting 'liquor nitrici hydrargyri.'" There is later a statement that an opening appeared again and was again injected, and finally there is the note that death occurred in 1827 at which time a fistula was still present. Other cases, some of them tracheal fistulae, were treated in a similar manner, the statement being made by the author that this "liquor nitrici hydrargyri" in a double strength was effectual since it irritated and excited a degree of inflammation in the mucous membrane lining, thereby bringing on contraction of the tract.

[1] The Genuine Works of Hippocrates. Francis Adams' Trans., vol. 2, sections on ulcers, fistulae, and hemorrhoids. N. Y., Wood.

[1] Dzondi, C. H. On congenital fistula of the trachea; a pathologico-therapeutic commentary, Schwetsche & Son, 1829; reproduced in the British Record of Obstetric Medicine and Surgery for 1848, vol. I.

* From the Department of Surgery of the Lakeside Hospital and the Western Reserve University School of Medicine, Cleveland, Ohio.

Our particular interest in this field was stimulated by the traditional and accepted practice in neurological surgery of attempting to fix the lining of certain forms of gliomatous cysts with Zenker's fluid, for the purpose both of killing the lining cells and of making the tissues tougher so that they can be more easily and surely removed. Experiments carried out by one of us in which various sclerosing and fixation fluids were used in cysts created in the brains of animals showed that a modification of Carnoy's solution was the most efficacious fluid which we could use. This solution is made up as follows:

Absolute alcohol	6 c.c.
Chloroform	3 c.c.
Glacial acetic acid	1 c.c.
Ferric chloride	1 gram

This solution has the qualities of moderate penetration with rapid local fixation of the lining cells and excellent hemostasis. It practically "tans" tissues, much as tannic acid as used in the treatment of burns, and causes far less local reaction than Zenker's solution, formalin or other fixatives heretofore commonly used for these purposes.

Fig. 1. A. Visualization of cyst and portion of right cervical fistula.

Fig. 1. B. Lateral view showing sinus tract leading up to pharynx.

For the past year, since the experimental proof was at hand, we have made wide application of this method of therapy in a variety of clinical conditions. At first we had expected to use this fluid in the treatment of gliomatous cysts in the brain, but our success in treating a case of cervical fistula two years previously with Zenker's solution led us to extend this method of therapy to the treatment not only of gliomatous cysts but of cervical fistulae and pilonidal sinuses. Unexpected success in the two latter conditions, heretofore requiring major surgical procedures but appar-

ently curable by an ambulatory treatment, has led us to make this report. The neurological surgeon will turn more easily to this method of treatment, since he has long been accustomed to use caustic fluids for the fixation of the cells lining gliomatous cysts as well as for hemostatic purposes. The experimental work has already been published[1] and shows the superiority of this fluid to the other fluids heretofore used. It is our chief hope that the general surgeon, as well as the neurological surgeon, will see the value and implications presented by these short case reports.

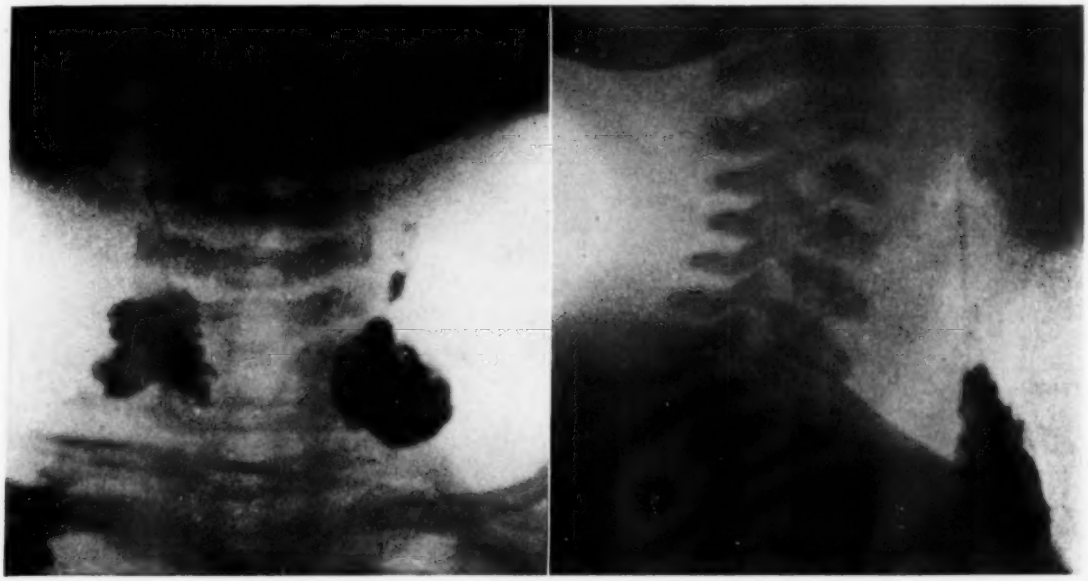

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Fig. 2. A. Bilateral cysts found with sinus tracts leading upward. B. Lateral view showing small sinus tract on right side leading to pharynx.

CASE REPORTS

1. *Neurological cases.*

Case 1. Gliomatous cyst (astrocytoma, left cerebellar hemisphere). M. B., a forty-three year old white man, was admitted to the Lakeside Hospital on January 22, 1932, complaining of headache at the base of the skull, staggering gait, loss of weight and attacks of nausea and vomiting. His present illness started in July, 1931, with a severe pain in the back of the neck. The physical examination showed a slight left facial weakness, positive Romberg sign and moderate ataxia of the extremities, most marked in the left leg. A diagnosis of cerebellar tumor was made.

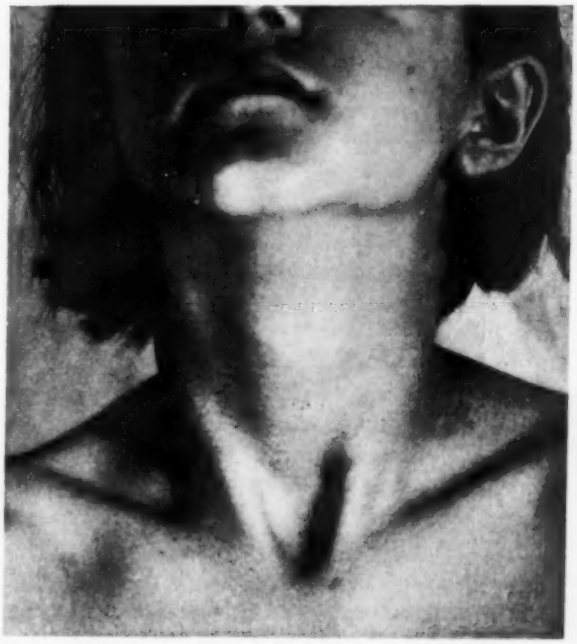

Fig. 3. Photograph of neck showing cystic area near border of left sternocleidomastoid muscle.

A cerebellar exploration was carried out on February 2, 1932. An astrocytomatous cyst

[1] Zollinger, R., and Moritz, A. R. Effects of necrobiotic agents on the walls of cysts experimentally produced in the brains of dogs. *Arch. Neurol. & Psychiat.*, 28: 1046–1055 (Nov.) 1932.

containing 15 c.c. of xanthochromic fluid was found at a depth of 3 cm. in the left cerebellar hemisphere. The modified Carnoy's solution which quickly clotted. The modified Carnoy's solution was applied to the walls of the cyst for one minute. This controlled all bleeding

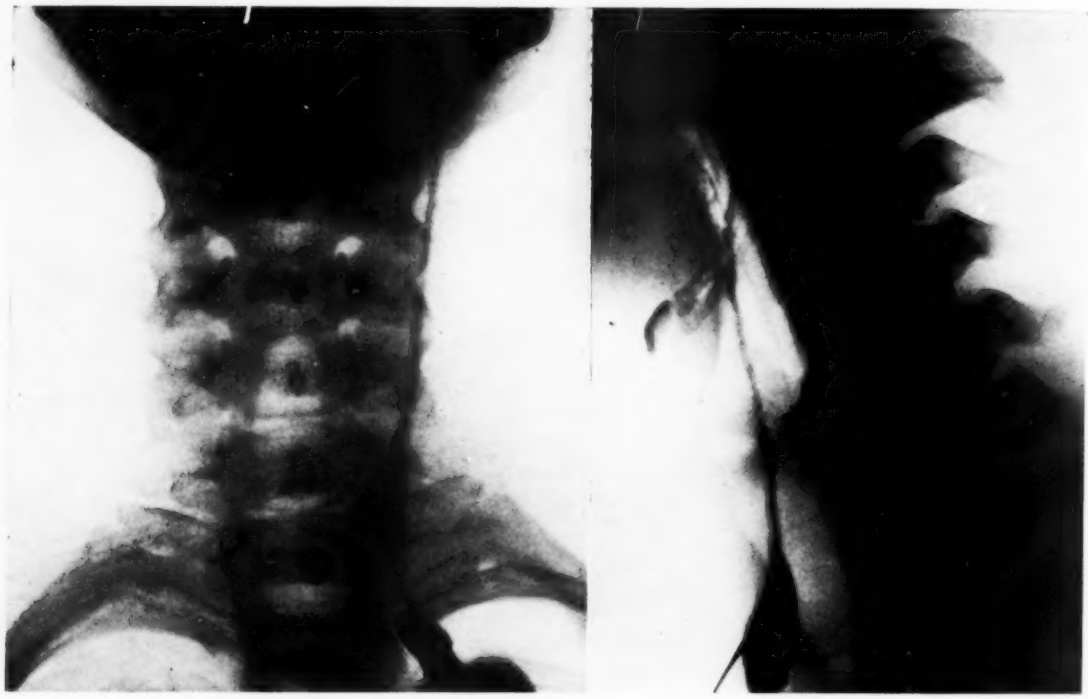

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FIG. 4. A. Injection of cyst with sodium iodide twenty-four hours after injection of sclerosing solution. B. Large sinus tract extends up to pharynx. Walls of tract have not been obliterated by reaction of fixative.

was applied to the walls of the cyst for one minute with cotton "paddies." This controlled the bleeding and toughened the walls of the cyst, making it easier to remove a large portion of the wall as well as a nodule of tumor tissue.

The histological diagnosis was astrocytoma fibrillare.

On the sixth postoperative day the patient's temperature reached 40°C. This promptly returned to normal limits following the removal of a small amount of xanthochromic spinal fluid by means of a spinal puncture. The patient was discharged on the sixteenth postoperative day.

CASE II. Gliomatous cyst (astrocytoma, left cerebellar hemisphere). J. K., a white boy of six years, was admitted to the Lakeside Hospital on January 7, 1932 because of headache, staggering gait and loss of vision. The history and physical findings were consistent with tumor of the cerebellum.

A suboccipital exploration was carried out and a gliomatous cyst found deep in the left cerebellar hemisphere. Thirty cubic centimeters of xanthochromic fluid were removed, points and the cyst wall became tough in consistency. This facilitated the removal of a greater portion of the cyst wall than would have been possible otherwise. Microscopic section of the tumor tissue removed showed it to be an astrocytoma. The postoperative course was uneventful and the patient was discharged on the fifteenth postoperative day.

II. *Cases of cervical fistula.*

CASE III. M. P., a white married woman of twenty-three, entered the Lakeside Hospital on November 25, 1930, complaining of a small cyst in the neck. She had had a small opening in the right side of the neck as long as she could remember. At times it would close and a mass would appear, which would rupture spontaneously and discharge a small amount of "secretion." During the intervals this had not produced any discomfort.

A small fistulous opening was found one inch above the insertion of the right sternocleidomastoid muscle into the clavicle. This was thought to be the localized remains of a

branchiogenic fistula. Excision of the area was decided upon. To facilitate this procedure methylene blue was injected with a blunt needle. Immediately the patient expectorated some methylene blue. An opening in the mid-portion of the right posterior tonsillar pillar was found. Lipiodol was injected and it showed a sac and a small tract leading up into the pharynx (Fig. 1 A and B).

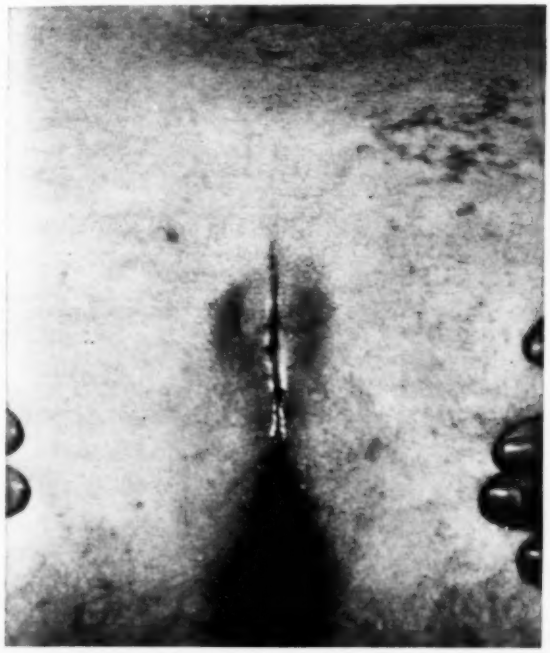


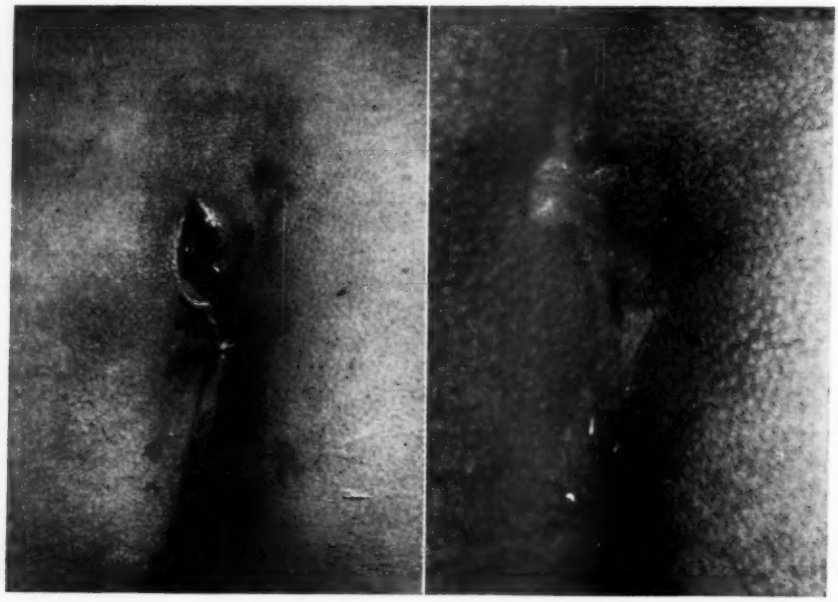
Fig. 5. Photograph of patient showing complete healing of pilonidal sinus thirty-eight days after first treatment.

The sinus tract was irrigated with Zenker's fluid on November 26, 1930. The pharynx was protected to allow the fixative to be forced entirely through the tract. This produced considerable pain. Morphine was given and in twenty minutes the sinus was irrigated with normal saline solution. The patient was discharged from the hospital on the following day. The fistulous opening has remained entirely healed.

Case IV. R. M., a white infant, sixteen months old, was first seen in the Pediatric Dispensary of the Lakeside Hospital on October 14, 1931. He was brought in by his mother because of two discharging sinuses in the neck which occasionally closed, resulting in a collection of cheese-like material just beneath the skin. The overlying crust would be removed by the mother, allowing this material to escape. For five months before admission thick greenish pus could be expressed from the left opening. If this was allowed to collect, the child became fretful and definitely ill. The physical examination showed a healthy appearing white infant with a small opening on each side of the neck above the clavicular insertion of the sternocleidomastoid muscle. There was a definite mass beneath the openings, most marked on the left side. Lipiodol was injected into the fistulae showing a small sac at the opening and on the right side a small sinus leading up to the tonsillar region (Fig. 2 A and B). On November 10, 1931, under ether anesthesia, methylene blue was injected into the right fistula and an opening was found in the upper portion of the right posterior tonsillar pillar. The modified Carnoy's solution was then injected through the tract into the throat under considerable pressure. Apparently some of the fixative escaped into the subcutaneous tissue about the opening of the fistula and sloughing of the adjacent skin resulted. On December 7, 1931, methylene blue was injected into the

Fig. 6. Photograph taken about six months after pilonidal sinus was first treated. Patient remains completely healed.

left fistulous opening, but no opening into the tonsillar region was found. The modified Carnoy's solution was then injected into the fistulous opening distending the terminal cystic area for two minutes. This time the skin was covered with vaseline and great care was exercised to avoid injection of the fluid outside the fistulous tract. Pus was discharged from the fistulous opening for a time, but this gradually ceased and the fistula healed completely. The right fistulous tract has also remained closed without evidence of cyst formation beneath the scar. This was the only case in which sloughing of the adjacent tissues resulted. This was prevented in later cases by covering all skin surfaces with which the fixative might come into contact with vaseline, and taking great care to inject the solution directly into the fistulous tract.



A B

Fig. 7. A. Appearance of wound shortly after application of solution, showing "tanning." B. Appearance of healed scar one month later.

Case v. M. J., a twelve year old white German girl, was first seen in the dispensary of the Lakeside Hospital on February 19, 1932. At that time she complained of a tender swelling on the left side of the neck which had been present for two days. A small opening was first noted about 2 inches above the left sternoclavicular articulation when the patient was two years of age. There had been an occasional discharge of serous fluid from the opening until three years before admission when a marked swelling had appeared. This soon subsided following the discharge of considerable pus.

The physical examination at the time of the first admission showed a fluctuant mass the size of a walnut at the edge of the left sternocleidomastoid muscle about 2 inches above the sternal notch (Fig. 3). The area was quite tender and was definitely involved in an inflammatory process. Pressure on the fluctuant area forced purulent fluid out of a small opening near the top of the left posterior tonsillar pillar. The fluctuant area was incised and pus obtained. The patient remained symptom-free for almost two months but returned to the Dispensary again on April 21, 1932, with a similar fluctuant area. Again this area was incised and drained. However, a small nodule persisted in the subcutaneous tissue which was slightly tender. There was no external opening. The patient entered the Lakeside Hospital for injection of the sinus tract on June 2, 1932.

Following the administration of morphine, 0.0081 gm., a blunt vasotomy needle was inserted through the old scar into the underlying cyst and methylene blue was injected. This distended the terminal cyst and also plainly visualized the internal opening of the fistulous tract. This opening was in the upper portion and near the free margin of the left posterior tonsillar pillar. The tract was then

irrigated with saline solution and the cyst was aspirated as much as possible. The vasotomy needle was allowed to remain in place and the sclerosing solution injected. The internal opening was surrounded with cotton and several times the solution was forced out on to the cotton about the tonsillar pillar. After five minutes the cyst was aspirated and saline solution irrigated through the tract. The entire procedure caused the patient but very little discomfort. The following day the tract was visualized with 25 per cent sodium iodide (Fig. 4A and B), showing the communication with the pharynx. It demonstrated that the sclerosing solution produced very little swelling as evidenced by the fact that the fistulous tract remained entirely patent.

The patient was seen on July 12, 1932, and the former subcutaneous nodule had entirely disappeared.

III. *Cases of pilonidal sinus.*

Case VI. H. L., a man of twenty-eight years, entered the Dispensary of the Lakeside Hospital on December 22, 1931, complaining of boils on his right arm and back. A boil on the right arm was incised and drained. A small abscess was found in the coccygeal region. The patient stated that he had had a draining sinus in this region for four years. Because of infection it had been incised and drained twice during that period. A probe could be passed upward into the sinus for over 3 cm. A diagnosis of infected pilonidal sinus was made and the sinus tract was opened on December 26, 1931, after infiltration with novocaine. The cavity was packed with vaseline gauze. Three days later, on December 29, 1931, the edges of the wound were covered with zinc oxide and the cavity was filled for ten minutes with the modified Carnoy's solution. The wound cleaned up rapidly with very little discharge. On January 5, 1932, the cavity was again treated with the necrobiotic agent for eight minutes and then packed with iodoform gauze. Gradually the cavity was filled with granulation tissue until by February 5, 1932, thirty-eight days after the first injection, the wound was entirely healed. A photograph (Fig. 5) was taken two months later, April 29, 1932.

Case VII. R. S., a white man of twenty-nine years, entered the Emergency Ward of the Lakeside Hospital on November 3, 1931, complaining of abscess above the anus. This had given him considerable trouble intermittently for eight years. A diagnosis of infected pilonidal sinus was made, and the abscess was incised and drained. When the patient was seen in the Dispensary the next day, a small fistulous opening was found just below the area of incision for drainage. This sinus extended downward several centimeters and upward expanded into a very large cavity. The modified Carnoy's solution was injected for five minutes. This distended a large cavity which extended more to the right of the midline than to the left. The cavity held 10 c.c. of the solution. There was practically no discomfort experienced by the patient during this injection. The solution was injected again the next day for ten minutes. The infection cleared up rapidly. The cavity was distended with the modified Carnoy's solution for ten minutes at two different times during the next two weeks. The destroyed tissue was frequently curetted away and a drain was inserted. To hasten the process and insure better application of the fixative, the roof of the sinus was incised, under novocaine anesthesia, and the cavity was packed with vaseline gauze. Tissue taken from the bottom of the cavity for biopsy was found to be chronic inflammation with no evidence of a cyst wall. The cavity was treated twice more for fifteen minutes each time, and gauze was inserted. The cavity was rapidly filled with granulation tissue. The small lower extension of the sinus was cauterized twice and the necrotic tissue curetted away. The wound was entirely healed by January 30, 1932. The patient, an *x*-ray technician, did not miss a day of work during the treatment. He has remained symptom-free. A photograph, taken April 28, 1932, shows no evidence of a fistulous tract (Fig. 6).

Case VIII. J. K., a white laborer twenty-five years of age, came to the Dispensary of the Lakeside Hospital on May 2, 1932, complaining of an abscess near the anus. The abscess had troubled him for the preceding nine months. A moderate sized, infected pilonidal sinus was found. This was freely incised and the sclerosing solution applied for a short time. This solution was applied daily for three more days. The cavity then gradually began to fill in with granulation tissue. Close examination, on May 23, 1932, showed two small sinus tracts at the lower end of the wound which had not been previously opened and treated. Novocaine was injected and the sinus

tracts opened widely. The sclerosing solution was applied for five minutes after covering the adjacent skin with zinc oxide ointment. The following day all necrotic tissue was curetted away and the fixative applied for three more minutes (Fig. 7A). By this time any remaining portion of the original pilonidal sinus had been exposed to the sclerosing solution and curetted away. The patient took frequent sitz-baths and continued his work. Within a month the cavity was entirely healed and there was no evidence of a residual sinus. It has remained completely healed (Fig. 7B).

DISCUSSION

These three groups of cases represent different conditions in which a sclerosing fluid may be a valuable supplemental therapeutic agent to the scalpel. Moreover, in cases of cervical fistula and pilonidal sinus, therapy may be carried on with the patient ambulatory, and not only is time saved for the patient but the ordeal of a radical surgical operation is done away with. Surgeons who have tried to dissect out the cervical fistulae of the type we have described in these cases, which originate in the tonsillar pillar and run downward to open just above the sterno-clavicular joint, know the Herculean task they impose upon themselves and their patients. The successful use of a chemical substance without risk to the patient and without the disfigurement of a scar as reported here suggests that this method should have much wider application. It is of course in the field of small fistulae with a lining membrane not more than a few cells deep that this method will find its greatest usefulness. We ourselves were surprised at the success obtained in cases of pilonidal sinus. After opening the pilonidal sinus widely, thus allowing the fixative to reach and destroy all the epithelial surfaces, the destroyed lining of the cyst wall was curetted away. Since the patient can be ambulatory during the treatment and since in our cases excellent results have been obtained, it is worth while perhaps to attempt this method in most of the cases seen, for radical surgery can always be resorted to later.

The use of this solution in neurological surgery needs little comment. Other solutions have been heretofore used. Our experiments have shown that the modified Carnoy's solution penetrates more quickly, produces less underlying encephalitis, makes thin cyst linings tougher and more easily handled, and is a better hemostatic agent. We have not had the opportunity to utilize this fluid in a typical suprasellar cyst, but it would seem that in such cases this fluid might also be a valuable adjunct to surgery.

SUMMARY

We have reported here cases of gliomatous cysts (astrocytomatous type), cervical fistulae and pilonidal sinuses in which a modification of Carnoy's solution used as a sclerosing agent has either greatly assisted in making an operation more complete, as in the cases of gliomatous cysts, or has been able to cure the condition without radical surgery, as in the cases of cervical fistulae and pilonidal sinuses.

THROMBOANGIITIS OBLITERANS

A CONSIDERATION OF THE DISEASE AND ITS MANAGEMENT*

HOWARD R. MAHORNER, M.D.

NEW ORLEANS, LA.

ONE of the most dreadful diseases which may attack a man is the fortunately uncommon condition, thromboangiitis obliterans. Much of the disability resulting from this affection is due to pain; pain which in many instances not only makes the patient incapable of work but from which he suffers sporadic or constant agony sufficient to make him gladly accept or beg for the mercy of an amputation. Unfortunately, attempts so far to master this disease have not been very successful. At least, one is never sure one can stop or abate its progress even when measures are of such a radical nature as amputation of one or more limbs. Milder measures directed against the symptoms or the actual progress of the disease have undoubtedly been of some benefit, but how much one cannot accurately say because each new mode of therapy so far has met with a period of enthusiastic acclaim, only to be doubted and then discarded or replaced by another.

When one begins to think of the most rational therapy for a disease, one looks back beyond the pathogenesis and perverted physiology into the etiology. The cause of thromboangiitis obliterans is unknown. Tobacco has been thought by some to be a factor in its production, but series of cases reported by different authors show that only from 60 per cent to 90 odd per cent of patients with the disease are smokers.[1,2] Eighty per cent of adult males of this country smoke tobacco, and one would be inclined to conclude that were this a factor, the disease would be much more common. Moreover, excessive smoking by patients with this disease may be caused by the nagging 'rest' pain, the wakefulness, and the resulting nervousness.

Thromboangiitis obliterans occurs almost exclusively in the male sex. It does occur in women, but it is extremely rare, and the ratio of female to male patients is in the neighborhood of 1 to 250. Such a discrepancy leads one to the thought that here might be an insight into the cause. The fact that men are generally on their feet more than women and that they are more often subject to exposure may be predisposing factors. The difference cannot be explained on anatomic differences and the foregoing reasons do not seem to be adequate explanations of the sex discrepancy.

Hebrews are more subject to the affection than Gentiles but it occurs nevertheless in the latter, and at the Mayo Clinic, the ratio of Hebrews to Gentiles with the affection is approximately one to one.[2] It probably affects all races, but reports have been lacking of its occurrence in full blooded negroes, and therefore, one should record such cases should they encounter them in this part of the country. It is not uncommon in China, and in Korea, the incidence is approximately the same as it is in this country.[3]

The histopathologic picture of the vessels affected in cases of thromboangiitis obliterans is strongly suggestive of an infectious process. Foci of infection are present in a large percentage of these patients, but so far, no definite relationship has been proved between these foci and the disease. Rabinowitz[4] isolated an organism having the same morphological and cultural characteristics from each of 5 cases of thromboangiitis obliterans and by injecting the culture into rabbits, he was able to reproduce thrombotic lesions similar to the ones occurring in this

* From the Department of Surgery, Tulane University School of Medicine, and the Charity Hospital, New Orleans.

disease. Horton and Dorsey[5] recovered pleomorphic streptococci from the inflamed veins or arteries in 9 of 34 cases of thrombo-

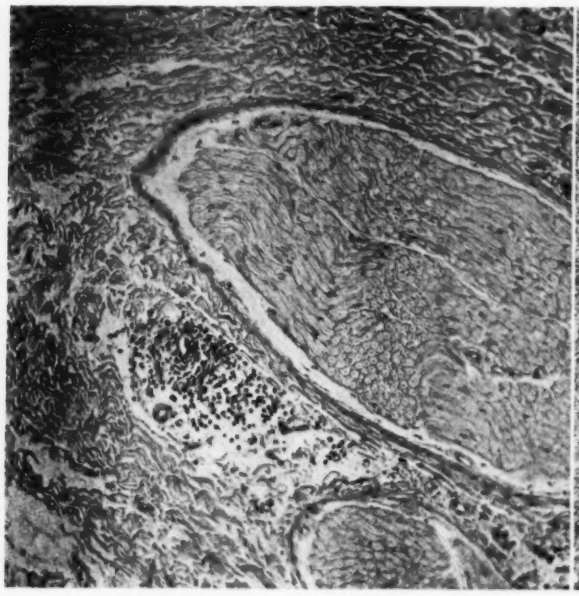


Fig. 1. Nerve from amputated leg (Case 1). Lymphocytes are seen clustered about small vessel. Perivascular lymphocytic infiltration is one of first changes in vessel affected by thromboangiitis obliterans.

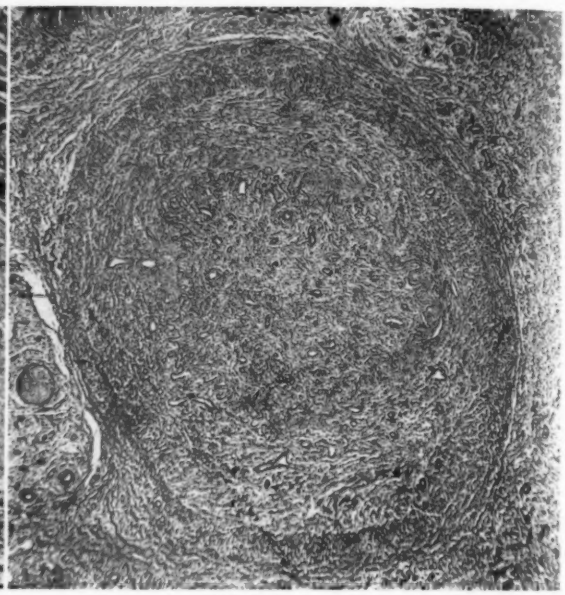


Fig. 2. Posterior tibial artery (Case 1). This shows end stage in pathogenesis of thromboangiitis obliterans. Occluding thrombus has been organized and recanalized and new vessels have been formed in media.

angiitis obliterans and from 2 cases, they recovered a green producing streptococcus. By imbedding acutely inflamed vessels from cases of thromboangiitis in muscles adjacent to femoral vessels of rabbits, they were able to produce lesions similar to those occurring in thromboangiitis obliterans in 9 of 29 of the animals.

So far, there is insufficient proof that any of these organisms is the etiological agent in thromboangiitis obliterans, but many things point to the infectious nature of the disease process and probably some day, this will be unequivocably proved.

PATHOLOGY

A diversity of opinion has existed concerning the pathogenesis of this disease. Buerger[6] published his first paper in 1908, and proposed the term "thromboangiitis obliterans," which conveys the true meaning of the pathologic process, inflammation of the vessels with thrombosis and obliteration of the lumen. Prior to that, the disease had numerous names, some of which are "endarteritis obliterans," "presenile gangrene," and "spontaneous gangrene." Endarteritis obliterans was a commonly used term and was the result of the early work of Friedlander and Winiwarter. Friedlander[7] described the pathologic processes which he observed in vessels in the region of infection; the intimal proliferation occurring in the vessels in the lung in pulmonary tuberculosis and bronchiectasis and in vessels of brains affected by syphilis. Friedlander termed this pathologic picture endarteritis obliterans.

Winiwarter[8] in 1879 gave a very detailed account of the pathology of the disease under consideration. He studied the vessels of an amputated leg from only one case. He thought that cellular proliferation of the intima progressed to complete occlusion of the lumen and designated the disease "endarteritis obliterans." His descriptions of various histopathologic appearances of the vessels in this disease were accurate, but his conclusions concerning the pathogenicity are not accepted today as the true explanation.

Other pathologic studies of note have been made by Widenmann[9] (1892), Manteuffel,[10] Haga,[11] Bunge,[12,13] and Todyo.[14]

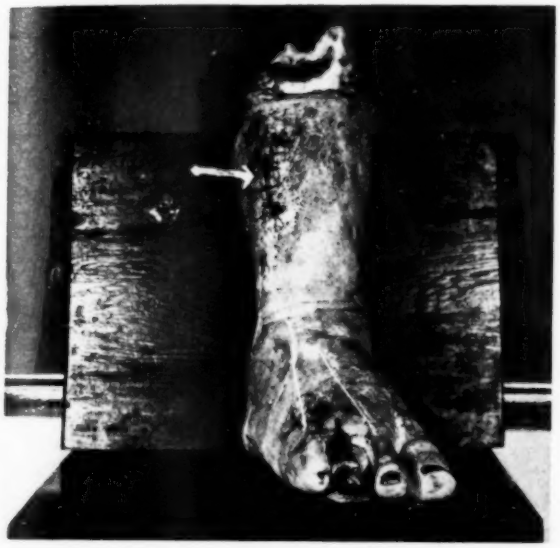


Fig. 3. Amputated leg (Case 1). Showing swelling of leg, absence of third toe, and gangrene of fourth. Gangrene also involved adjacent part of plantar surface. Arrow indicates incision through which cutaneous branch of musculocutaneous nerve was injected with alcohol. Area of anesthesia which resulted was between converging white lines on dorsum of foot.

Buerger[5] in 1908 advanced a new conception of the pathogenicity. His studies led him to the conclusion that the disease is an acute inflammation of the vessels resulting in thrombosis with subsequent organization and recanalization.

In 1928, I reported in a monograph[2] with Brown and Allen, the results of my pathologic studies on material obtained from 25 cases of thromboangiitis obliterans. Though it was evident from these studies that acute inflammation of the vessels does occur in this disease, in no instance in this study was there lacking in the vessels evidence of a chronic inflammatory process and sometimes, chronic inflammation was present in the vessel wall without evidences of acute inflammation. This study led to the conclusions that in the first stage, there is a chronic inflammation of the vessel characterized by perivascular lymphocytic infiltration (Fig. 1) and proliferation of the adventitial connective tissue, thickening of the intima of the vessel which is of a very cellular character and not similar to the thickening which occurs in arteriosclerosis.

Fig. 4. *X*-ray of leg shown in Figure 3 after anterior and posterior tibial arteries had been injected with opaque medium. Arrow indicates occlusion in one of tibial arteries. Part of collateral circulation is shown.

Thrombosis is superimposed on this preliminary inflammatory stage and at the time of the precipitation of the thrombus, there may be a marked polymorphonuclear leucocytic infiltration. The thrombus occludes the lumen and organization and recanalization takes place, new vessels form in the media and adventitia (Fig. 2) and there is a tremendous effort on the part of unaffected vessels to form a collateral circulation. The artery, vein and nerve are bound firmly

together by the perivascular fibrosis and are very difficult to separate from one another. The vasa nervorum sometimes

Fig. 5. *X*-ray of foot after arteries of leg shown in Figure 3 had been injected with opaque medium. Collateral vessels are shown. Posterior tibial artery is not outlined, though it was injected at site of amputation.

show perivascular collections of lymphocytes. Moreover, probably due to ischemia, the peripheral nerves in an affected extremity often show marked degenerative changes, absorption of myelin and proliferation of the epineurium.

The vessels generally affected are those of the extremities, the lower more often than the upper. Reports have been made of the process even involving visceral vessels.[15]

SYMPTOMATOLOGY

The symptoms of thromboangiitis obliterans are the result and expression of ischemia with occasionally the added pain and subjective signs of inflammation in veins.

The first thing the patient will probably notice is a tired feeling in the calf of the leg. Perhaps at this time also, he will observe little tender lumps or cord-like areas under the skin of the leg. This is the migrating phlebitis which occurs in approximately a third of the cases and which for months or years may be the only subjective or objective manifestation of the disease. Later, intermittent claudication may indicate more serious vascular occlusion. The patient, after walking several blocks or less, finds that a severe cramp in the muscles of the calf compels him to stop and rest and that after a sufficient period, he may start again in comparative comfort, only to have a recurrence of the same phenomena. He notices that the foot of the affected leg is easily chilled, that it has a peculiar reddish purple color, that there may be edema of the foot and lower leg which is due to thrombosis in the veins. The nails undergo trophic changes, become thickened and brittle, and the skin, especially in the absence of edema, has a glazed appearance and loses its normal pliability and fits tightly. Some or all of the pulses in the affected extremity are diminished or absent. The patient then may have pain, even at rest, and this is the most severe and troublesome of all the symptoms. The static pain generally occurs in the foot, either in the instep or on the dorsum near the outer surface or in the toes. This is a constant severe nagging, aching or burning pain. It must be very intense at times because patients complain bitterly of it. Only morphine may give relief, and they will even beg for amputation. They lose rest and sleep and become haggard and worn, and have a look of anxiety which bespeaks suffering. Because of such constant agony and loss of sleep, their nervous systems are greatly taxed and they can have no other view or thought than relief from their suffering. Dependency of the part relieves this pain somewhat and they often sleep sitting up. They may have nightmares and are given to prowling about at night.

Finally, they may develop small ulcers which heal slowly or become larger. Gangrene of a toe may ensue. It is generally dry and advances slowly or rapidly, depending on the progress of the disease in the vessels above. With the onset of gangrene, the pain generally becomes worse. When symptoms of involvement in one limb so incapacitate the individual that

he is not very active, he may not notice the disease in other extremities but objective examination may reveal diminished or absent pulses, the peculiar characteristic purplish red color (erythromelia), quick blanching on elevation and tardy return of the normal color when the limb is lowered. The disease may involve the upper extremities and express itself by pain in the fingers, gangrene and the objective signs of vascular occlusion, blanching, absent pulses, atrophy of the skin, and trophic changes of the nails.

In this disease, it is generally the pain which incapacitates the individual, stops him from work, and makes him seek relief. The patients do not look or feel acutely ill. They do not have fever or constitutional symptoms other than those resulting from the effects of the pain on the nervous system or the presence of gangrene or, in rare instances, those symptoms due to involvement of visceral arteries. If it were not for the pain, most of these patients could live fairly happily by restricting their activities and it is this symptom we are most anxious to relieve, most gratified when this is accomplished. When the disease involves visceral arteries, it expresses itself like other thromboses of these arteries; e. g., coronary occlusion or mesenteric thrombosis. Visceral symptoms may be intermittent or death may ensue from gangrene.[15]

DIAGNOSIS

Thromboangiitis obliterans should not be difficult to diagnose. Frequently, however, the condition is called something else. In one of the cases (Case II) herein reported, a diagnosis of multiple neuritis had been made and again the lesion on his toe had been diagnosed epidermophytosis. Epidermophytosis really may have been present but probably most of the changes on which the dermatologist based his diagnosis were the trophic changes of thromboangiitis obliterans, the presence of which apparently no one at that time suspected. If the physician is aware of thromboangiitis obliterans as a possibility and bears in mind a few characteristic manifestations of the disease, he will have no difficulty in making the correct diagnosis. The high incidence in the male sex and the infrequent occurrence in women is a differential point of great helpfulness. If a man in otherwise good health has one or several attacks of unexplained phlebitis and complains of a tired feeling in the calf of his leg, thromboangiitis obliterans should be suspected even if his pulses are present and there are no other objective signs. The peculiar purplish red color of the feet on dependency, the cadaveric blanching on elevation, the tardy return of color when the limb is lowered, the absence of pulses, the occurrence of migrating phlebitis are characteristics which leave little room for doubt as regards a positive diagnosis.

Raynaud's disease occurs almost exclusively in women. It is characterized by functional spasm of the vessels which at the onset is intermittent. An attack is precipitated by exposure to cold and is relieved by heat. The disease is bilateral and symmetrical. Pulses may be felt in periods of remission and the peculiar reddish purple color of thromboangiitis obliterans is generally not evident, but the part is blanched. Gangrene may supervene after a long time but the history and objective findings should obviate the difficulties of a differential diagnosis.

Gangrene resulting from frost bite is not difficult to differentiate. The history is most important. One should, however, not fail in these instances to inquire into the past history for symptoms of thromboangiitis obliterans since patients with this affection are more susceptible to frost bite. A careful examination must be made to rule out any evidence of vascular occlusion.

Erythromelalgia is a rare affection. It is a functional disease and is in many respects the counterpart of Raynaud's disease. Erythromelalgia was described and named by Weir Mitchell[16] and it is characterized physiologically by a vasodilatation of

vessels in the affected extremity. The part becomes dusky red in color, the vessels are full and throb and the patient experiences a severe burning pain. The attacks are intermittent, the pulses are palpable and dependency increases the discomfort. The disease is worse in the summer; the patients like cold and often leave the affected part uncovered.

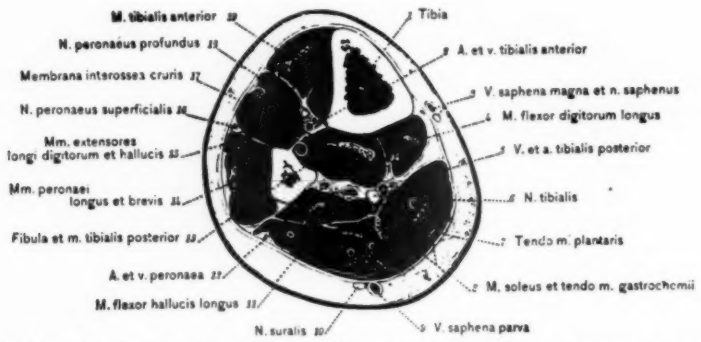


Fig. 6. Cross section of leg about 5 inches above ankle, showing relation of nerves at that area. Anterior and posterior tibials, cutaneous branch of musculocutaneous and sural nerves must be injected to produce anesthesia in entire foot. (From Eckleshymer and Schoemaker.)

Arteriosclerosis may be differentiated from thromboangiitis obliterans by consideration of the age of the patient, the condition of the arteries elsewhere in the body, and the *x*-ray evidence of the presence or absence of calcium in the vessels. Diabetes should be ruled out by tests for glycosuria and if necessary hyperglycemia. In arteriosclerosis, migrating phlebitis does not occur, the pain is less severe and the rubor, if present, is less intense. Arteries of arteriosclerosis may be palpable if pulseless. Pulseless vessels in thromboangiitis obliterans are generally not perceptible to touch.

ILLUSTRATIVE CASES

Case 1. P. D., male, aged forty-three, carpenter of French descent who had always lived in Louisiana, was admitted to Charity Hospital, October 6, 1931. Married, his wife and two children were living and well. He had been a moderate smoker for years; ten to twelve cigarettes a day. Since January, 1931, he had experienced a slight burning pain in the right foot and since June, 1930, a crampy pain in the right calf on walking. This pain had gradually occurred with less and less exertion and during the months prior to admission, he was able to walk but a block without its appearance. When it did occur, he was compelled to stop and rest. In June, 1931, he began to have a severe pain in the toes of the right foot even at night and this allowed him only interrupted sleep. About four weeks before admission, he developed an infection around the nail of the middle toe of the right foot. He pulled the nail off himself and the toe became and continued to be intensely painful. Just before admission, he developed a punched out ulcer on the outer aspect of the dorsum of the right foot. He suffered severe pain in the toes and the outer part of the right foot. The pain was less intense when the foot was dependent. He had had no attacks of phlebitis and had experienced no trouble in any other extremities.

For ten years, he had had an anal fistula. He did not have any distress from this unless it stopped draining at which times it would be painful until it "broke open" again. For ten years, he had had an enlarged left scrotum. During the past year, he had noticed a small painless soft protrusion about the size of an orange in the right iliac region.

There was no history of lues and his family and past medical history contain no relevant information.

Examination: The patient was a well-developed middle-aged man who showed signs of evident painful distress. He looked haggard and worn. He sat in a chair and kept his feet in dependency and insisted on maintaining this position. The examination was essentially negative except for the following objective findings: The right foot was of a purplish red

color, especially in the peripheral part. There was slight edema of the foot. The third toe was reddish and tender. The nail was missing and there was an ulcer of the nail bed. On the outer side of the dorsum was a punched out ulcer about 1 × 1 cm. Pulsation of the right dorsalis pedia and posterior tibial arteries was not perceptible. The right foot blanched quickly on elevation and resumed its usual color slowly when lowered. The left leg and foot was objectively negative and the pulsations of the vessels were normally palpable. In the right iliac region was a small ventral hernia about 4 × 6 cm. In the left scrotum was a hydrocele 6 × 12 cm., and posterior to the anus was found the external opening of an anal fistula. The Wassermann reaction was negative; urinalysis was negative; *x*-ray of chest negative.

This patient suffered the most severe pain in the toes and outer side of the right foot. He was given contrast baths and baking and between October 13 and October 26, he had four intravenous injections of typhoid vaccine. Though this may have afforded him some relief of pain the days immediately following the injections, the result was not very gratifying. The skin lesions did not heal and gangrene of the right third toe progressed slowly. On October 26, 1931, he developed a migrating superficial phlebitis on the inner side of the right leg. On October 29, he had marked edema of the right leg below the knee and a hard rope-like structure the size of a finger was felt in the popliteal space, undoubtedly a thrombosed popliteal vein. On November 8, 1931, the right third toe was amputated at the base. This did not heal and the patient was suffering excruciating pain and begging for amputation. On November 19, I injected the cutaneous branch of the musculocutaneous nerve with 90 per cent alcohol about 5 inches above the ankle joint. This resulted in a small triangular area of anesthesia on the dorsum of the foot from the second to the fifth toe (Fig. 3). He went to sleep immediately after this and the following day said he had had the best night's rest in months. The relief was striking but it lasted only a few days because the gangrene advanced to the plantar surface of the foot and also involved the fourth toe. It seemed useless to palliate longer with the advance of gangrene. The incision for nerve injection had healed.

On December 3, 1931, under spinal anesthesia, I amputated the right leg at the junction of the upper and middle thirds, disarticulating the fibula at the superior tibio-fibula articulation and removing it entirely.

Since then, he has been comfortable and happy. The wound healed promptly on the inner two thirds but there was some sloughing in the outer third. It was entirely healed February 16, 1932.

Case II. S. L. B., aged twenty-six, male, of French descent, was admitted to Charity Hospital five times between July, 1930, and November, 1931. On his first admission, he gave a history of having recurrent attacks of cramp-like pain in the right calf which was only evident on exertion. This had been present for five years. In September, 1930, he noticed a burning pain in the right fourth toe and it became gangrenous (amputation not recorded in history). In May, 1931, he returned and was given six injections of typhoid vaccine intravenously. The febrile reaction varied from a slight rise to a temperature of 102°F. This apparently benefited him. It at least relieved his pain temporarily. He returned again November 16, 1931. Examination then revealed a thin young adult male. He used crutches and his left leg and carried his right leg flexed at the knee. The right fourth toe was off at the base and the wound was healed. His right foot was of a dusky reddish purple color, especially in the distal part. It quickly blanched livid on elevation and the color returned slowly when it was lowered. The dorsalis pedis and posterior tibial and right popliteal pulses were not palpable. The skin of the foot was glazed and fit tightly. The left foot was somewhat blanched even on dependency and the left posterior tibial and dorsalis pedis pulses were not palpable.

This patient did not experience any subjective manifestation in the left lower extremity though the disease was present there, too. It was probably only because of his restricted activity that it did not manifest itself to him. He was fairly comfortable but incapacitated. He had a mild degree of "rest" pain in the right foot. He was given contrast baths and typhoid vaccine, which was administered intravenously November 20 and again November 22, but he did not feel benefited and objected to further treatment by this method. His disease had apparently reached an arrested stage but the compensatory circulation was far from adequate. He deserted November 30, 1931.

TREATMENT

Various measures have been advocated in the treatment of thromboangiitis obliterans. It is well to bear in mind that though we do not possess any specific mode of therapy and are powerless to stop the progress in some cases nevertheless the disease tends in other instances to run a self-limited course and the collateral vessels attempt and do sometimes accomplish a satisfactory compensatory circulation with which the patient may live a useful but restricted life. The conservative policy is the better one and palliation should be tried for a sufficient length of time until progress of the disease demands radical measures. In other words, the presence of the disease in an extremity does not call for early amputation and this should be delayed as long as possible. Every case deserves individual judgment and no specific rules will hold good for all. Since this is an extremely chronic affection and an extremely expensive one, the economic element must play a large part in the consideration of management. The affection usually occurs in the period of life in which a man is a most active wage earner and it would be absurd to carry palliation to such an extent that an individual would spend a year or more in a hospital with one limb affected, suffering and incapacitated all the while, with such progress of the affection that amputation seems inevitable.

Measures to prevent gangrene must be observed in this disease. The patient must be cautioned about keeping the feet clean, avoiding tight shoes, and inadvertant trimming of corns and nails. In the absence of open lesions, contrast baths should be used twenty minutes twice a day, keeping the extremity immersed one minute alternately in water at 45°F. and 105°F. This probably has some beneficial effect on the development of collateral circulation. Baking in a tent under heat from electric lights is a helpful measure and should be done twice a day for thirty minutes. These measures may help to improve circulation and may be used by the patient at home. Postural exercises have been advocated and probably have some slight value. The patient alternately elevates and lowers the extremity for about one minute each, and performs this some twenty times. Though we are not sure of the part tobacco plays in the etiology, it may be a factor and patients with the disease should stop smoking.

Ringer's solution and sodium citrate intravenously have been used in the past with indifferent results. This mode of therapy derived its rationality from the incorrect conception that the viscosity of the blood is increased in this disease. Intravenous fluid administration was supposed to mitigate against this increased viscosity and the citrate was also advocated because of its anticoagulant effect. More encouraging results have been obtained from other measures.

Typhoid vaccine intravenously has given encouraging results in some cases. The method is to start with about 15 million of the triple vaccine and increase as the patient becomes tolerant. The injections are given intravenously every three or four days and the vaccine may be increased, depending on the reaction the patient gets; e. g., first dose, 15 million; second dose, 20 million; third dose, 30 million; fourth dose, 40 million, etc. Four to six doses should be given at one time with an interval of rest of six weeks following this and if necessary another course.

About one or two hours after injection, the patient gets a mild headache which gradually increases. He feels badly and from two to three hours after the vaccine, he may be seized with a severe shaking chill which lasts about thirty minutes. The temperature rises to 100° to 102°F., and sometimes (undesirable) even higher. He aches all over and suffers the malaise, slight nausea and distress incident to the acute onset of an infectious disease. After several hours, the fever subsides and he feels better. The following day, he may

have mild fever, 99°F., but generally in twenty-four hours, the reaction has passed off.

Very often, patients will have some relief of pain from this mode of therapy and yet sometimes it does not seem to help them. I have seen a very mild case of thromboangiitis obliterans the progress of which I felt sure was stopped by typhoid vaccine. But this mode of treatment is by no means a very simple one, nor is it entirely safe. The patients suffer a to be sure transient, but nevertheless severe, acute illness and marked reactions are to be feared. It is a form of therapy to be tried, but replaced if the results are not forthcoming after three to four treatments. I did not feel that it resulted in much benefit in either of the foregoing two cases when they were under my observation and Case 1 developed thrombosis and had rapid progress of the disease between the third and fourth injection. This shows that thrombosis does occur even when intravenous vaccine therapy is being administered. I do believe that this mode of therapy has been overpopularized and that we have other measures at our command which probably will prove of more benefit in relieving pain and tiding a patient over a period in which there is rapid progress of the disease. One of these is the injection of peripheral nerves with alcohol.

Smithwick and White[17] described a method of anesthetizing part or all of the foot and lower part of the leg by injecting the nerves about 6 cm. above the ankle. The injection generally results in anesthesia for about three months. Intrinsic muscles of the foot are paralyzed for a similar length of time but this does not result in any marked disability. This is a very rational procedure in patients suffering great pain because it not only gives complete relief from this but also paralyzes the vasoconstrictor fibers distal to the point of injection. In its vasodilator effect, however, it is not as efficient as lumbar ganglionectomy which accomplishes the same thing for the entire extremity.

Lumbar ganglionectomy, much better than periarterial sympathectomy, which probably has no place in the treatment of this disease, should be considered in the therapy of thromboangiitis obliterans for two rational reasons. The first is the fact that such a procedure relieves vasoconstriction in all the vessels of the extremity, allowing collaterals to furnish more vascular area, and the second is that sometimes there is an added spasm of the vessels in an extremity affected by this disease, known as Raynaud's syndrome. The presence of this may be proved by comparing the rise of the temperature in an affected extremity with the rise in body temperature after the injection of typhoid vaccine. Brown[2] has made practical use of this in the selection of suitable cases for ganglionectomy. He determines the vasomotor index by comparing the increase in skin temperature in the extremity with the increase in body temperature. If the increase in surface temperature of the affected extremity is twice as great as the increase of body temperature, he concludes that there is enough vasospasm to warrant sympathetic ganglionectomy. Good results from this operation have been reported but because the essential lesion in this disease is absolute occlusion of the vessel and not functional spasm, too much must not be expected from the procedure, and very careful selection of the cases must be made. In Case 1 herein reported, ganglionectomy was thought inadvisable because of the low vasomotor index.

While one should use every means to obviate the necessity of amputation, this still unfortunately is often the only means we have of returning the patient to sufficient health to be an asset instead of a liability to himself and family. No strict rules may be made for the time and level of amputation. Gangrene which is rapidly progressing and which cannot be controlled by other less radical measures demands surgical intervention. Severe persisting incapacitating pain as well as the economic situation of the patient are also con-

siderations. The site of amputation must be selected, bearing in mind the value of conservative preservation of as much of the extremity as possible and at the same time, the poor blood supply which mitigates against healing. It is not always necessary to amputate above an area in which pulsation may be felt in the main vessels but one should amputate sufficiently high above an area of gangrene to be able to expect healing. Pachon's oscillometer probably affords the most scientifically accurate information of the vascular tree at any given level[18] as a determination with this instrument furnishes some idea of the whole blood supply to a part and not only the condition of the main vessel.

Some day, someone may be fortunate enough to discover the true cause of this disease and then we will be much nearer the rational approach to the true cure.

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A STUDY OF

THYMOPHYSIN IN FIRST STAGE OF LABOR

WITH SOME OBSERVATIONS ON ITS EFFECT ON BLOOD PRESSURE*

MAURICE G. DERBRUCKE, M.D.

BROOKLYN, N. Y.

SINCE the introduction of thymophysin in 1925, by Temesvary, several reports have appeared in various American journals.[1–4] The published clinical evidence seems to corroborate the European reports, despite the pharmacological experiments of Rucker[5] and Nelson.[6] Although they arrive at the same conclusion, namely, that thymophysin in its behavior is nothing more nor less than pure pituitary with some apparently inert extract of thymus, analysis of their separate experiments, coupled with the accepted findings of the in vivo and in vitro behavior of some endocrines, as epinephrin and thymus in particular, seems to show that further experimental work is required.[7, 8]

DeLee[9] deprecates the promiscuous use of thymophysin in or during the second stage and in this opinion the majority of obstetricians will concur. All things being equal, it is seldom necessary to employ an oxytocic at this time. Occasionally there is a rather prolonged delay, but an examination of the passages and passenger may soon reveal the source of this difficulty. In these cases rupture of the membranes, episiotomy or low forceps will probably do less damage to mother and infant than the rapid propulsive and expulsive force of an ecbolic such as pituitary or thymophysin.

It was with a view to lessening the fatigue, anxiety, and the time in the first stage, that we undertook the study of the action of thymophysin. It is not the intent of nature to punish maternity. But to endure small, short, nagging pains during the period of dilatation is certainly unnecessary. If we can convert these tiring, futile pains into effective ones, and thereby shorten the first stage, without doing harm to either mother or child, we are aiding nature and carrying out her wishes to the ultimum. For years we have been striving to attain just such a condition, and I feel we have made a forward stride in the judicious employment of thymophysin.

For the purpose of demonstration I have selected 65 patients, taken from my private service at the Bushwick Hospital, Caledonian Hospital and from the Department of Obstetrics of the Coney Island Hospital.

Twenty-nine were primiparae, and 36 multiparae. Gravidity ranged from 1 to 13 pregnancies. All were in the first stage. One was three and a half fingers dilated, one three fingers, and two were two and one-half fingers dilated. All the primiparous as well as the remaining multiparous women ranged from very little dilatation to two fingers' dilatation. Three of the total number were not in active labor, but are included in as much as thymophysin was administered with a view to stimulating the onset of uterine contractions and labor. For the initial dose, 20 multiparae and 20 primiparae received a full ampoule or 1 c.c., while 16 multiparae and 9 primiparae patients received half ampoule doses.

LABOR

The interval between pains on admission and prior to the administration of thymophysin ranged in the multiparae from no perceptible pains at all, down to pains appearing every five minutes. The average mean interval was ten to fifteen minutes. In the primiparae the range was from no pains to pains coming every fifteen min-

* From my private service at the Bushwick and Caledonian Hospitals, and the Department of Obstetrics, Coney Island Hospital, Dr. Harvey B. Matthews, Director.

utes, the average mean being twenty-five minutes.

Onset: The first pain in the multiparae occurred within 5.9 minutes, (av. m.) of the injection in those who received an initial full dose and 2.7 minutes (av. m.) in those who received a half ampoule. In the primiparae, the first pain appeared in 5 minutes (av. m.) for the whole ampoule and 4.25 minutes after the half ampoule. There is nothing definitely striking about these figures, although the lapse of time between the injection and the appearance of the first pain in the multiparae varied from 1 to 40 minutes and in the primiparae from 1 to 28 minutes.

Frequency: The frequency of the recurrence of pains when tabulated showed some very interesting data in the light of the subsequent findings. The interval between pains in the multiparae who had received the full initial dose varied from 1.6 to 2.6 minutes, as compared with 2 to 2.66 in those who had had only half the full dose. The multipara who had received the larger amount had 24 seconds longer rest.

The same held true in the primiparae. The frequency of the pains in the recipients of the full ampoule being 2.9 to 3.6 minutes, as compared with the half ampoule figures of 2.5 to 3.25 minutes, again showing a longer period of apparent rest in the case of the initial larger dose.

Length of Duration of Pains: The duration of each pain, taking the average mean in each group, bore a relation similar to the groups analyzed under "Frequency." There is little difference in the average mean length of pains in the parous groups, 24–45 seconds for the whole ampoule and 25–37.5 seconds for the half, although the individual variation ranged from 10–70 seconds. In the primiparous groups, however, there is a distinct increase in the duration of the pains in those who received the entire ampoule. In this class there were at least two in whom the pains lasted from 1–2 minutes and 1–3 minutes (Rec. 35 and 29 respectively). In the group of primiparae who received only half the ampoule, there was only one patient in whom the pains lasted 1 minute (Rec. 46). The average mean length of time for the pains in the full dose group was 35.6–57.9 seconds and for the half dose group 33.1–45.6 seconds.

Time of Full Dilatation Noted after Injection: The average mean dilatation time for the multiparae who had been given the whole ampoule was 3 hours, 24 minutes and for the half ampoule 3 hours, 36 minutes. The primiparae reached full dilatation in 5 hours 12 minutes, after the entire dose and 6 hours, 54 minutes after the half dose. In the parous groups there is no appreciable gain of time in those cases who received the whole ampoule as compared with those who had the half ampoule. On the other hand, there is a saving of 1 hour and 42 minutes for the primiparae who had had the full dosage.

Delivery in most cases followed within the normal time after full dilatation, although the individual time ranged from 5 minutes to 16 hours. It is quite apparent that nothing is gained by giving a multipara an initial large dose. This view is supported by my findings in connection with the action of thymophysin on the blood pressure.

The neuromuscular elements respond almost to their fullest degree in the multiparae to the pressor action of the half ampoule of thymophysin. It does not seem likely that a smaller amount would be as effective, for even with the half dose, there is a definite delay in the frequency of the pains, and a slightly longer labor.

BLOOD PRESSURE

The physiological difference between the multiparae and the primiparae is quite marked in a study of the blood pressures. Nearly all the blood pressures records obtained were taken just prior to and within ten minutes after the administration of the oxytocic.

Primiparae: The average mean pressure before the injection of 1 c.c. of thymophysin was 125 systolic and 88 diastolic, and an average mean systolic of 141 and a diastolic

of 97 after. The amount of systolic rise varied from 4 to 20 mm. Hg, the average mean being 16 mm. Hg. The diastolic rise ranged from 4 to 18 mm. Hg, the average mean being 9 mm. Hg, giving a positive of 16:9.

TABLE I
BLOOD PRESSURE IN PRIMIPARAES FOLLOWING 1 C.C. DOSE

Rec.	Systolic		Diastolic	
	Before	After	Before	After
21	136	152	98	102
23	128	142	86	96
27	118	136	88	100
31	130	134	98	98
36	120	138		
37	118	138	72	90
Av. mean..	125	141	88	97
	16	:	9	

The primiparae who received the half ampoule showed a striking parallel. The average mean pressure before the injection of the oxytocic was 127 systolic and 81 diastolic. After the hypodermic it was 144 systolic and 91 diastolic, showing a definite rise in the systolic pressure of 17 mm. Hg and 10 mm. Hg in the diastolic pressure, or a positive ratio of 17:10.

TABLE II
BLOOD PRESSURE IN PRIMIPARAE FOLLOWING HALF AMPOULE DOSE

Rec.	Systolic		Diastolic	
	Before	After	Before	After
39	132	140	90	100
40	132	150	70	90
41	120	170	72	86
42	132	126	90	86
43	130	152	76	92
44	114	118	72	72
45	136	152	96	108
46	120	132	80	94
Av. mean..	127	144	81	91
	17	:	10	

A comparison between the two primiparous groups shows that the maximum cardiovascular response is obtained with the lesser dose.

Multiparae: There was a rise in all cases, except in Record 15. This patient showed a slight change in the diastolic pressure only. In the others the systolic rise ranged from 6–50 mm. Hg, the average mean being 16. The diastolic pressure varied from a −4 to a +32 mm. Hg, the average mean being 4 mm. Hg. The ratio in this group was 16:4.

TABLE III
BLOOD PRESSURE IN MULTIPARAE FOLLOWING FULL AMPOULE DOSE

Rec.	Systolic		Diastolic	
	Before	After	Before	After
1	118	130	60	92
4	168	198	110	110
8	124	136	78	78
9	138	146	92	90
10	112	122	80	76
11	144	152	110	110
12	140	162	104	118
14	166	170	106	108
15	96	96	64	70
16	112	118	82	84
17	142	152	86	84
18	90	110	60	64
19	112	162	98	100
20	138	162	96	128
Av. mean..	128	144	89	93
	16	:	4	

The group of multiparae who received only half of the ampoule showed in the main, a rather poor cardiovascular response to this smaller dose. The average mean pressure before the administration of thymophysin was 134 systolic, over 90 diastolic. After the hypodermic it was 140 systolic over 94 diastolic. In one instance the systolic pressure dropped 12 mm. Hg and the diastolic fell 18 (Rec. 49). The average mean is only plus 6 systolic and plus 4 diastolic, or a ratio of 6:4.

It is interesting to note that in the parous groups the diastolic pressure in quite a number of instances either remained unchanged or varied slightly. Correlating the average mean pressures both in the multi-

parous and primiparous divisions we uncover some very interesting data.

TABLE IV
BLOOD PRESSURE IN MULTIPARAE FOLLOWING HALF AMPOULE DOSE

Rec.	Systolic		Diastolic	
	Before	After	Before	After
49	138	126	108	90
50	132	142	94	100
51	152	164	80	90
52	98	110	72	80
53	126	132	86	94
54	130	142	100	102
55	168	172	100	108
56	110	110	70	70
57	124	134	72	82
58	138	138	108	108
59	160	160	100	100
60	130	146	98	108
Av. mean..	134	140	90	94
	6		4	

In the multipara a full ampoule will cause an average mean rise of 16 mm. Hg, in the systolic pressure, and 4 mm. in the diastolic pressure, while the half ampoule will give a positive average mean rise of only 6 mm. Hg, and 4 mm. in the diastolic.

On the other hand, in the primiparae the full ampoule causes a rise of 16 mm. average mean, in the systolic pressure and 9 mm. in the diastolic. The initial half ampoule dose, much to the contrary of what we might expect, shows practically no deviation from the larger dose, the proportion being 17:10.

How are we to account for the difference between the two major groups? An explanation may be sought and perhaps found in the degenerative changes which have taken place in the multiparae, as evidenced by the milder response to the smaller dose. In the primiparae generally there is an equal cardiovascular response to the half ampoule as compared with that of the full dose.

A careful study of the diastolic pressure in Tables I–IV, and especially in the parous groups, has led me to the following conclusion: the cardiovascular system of the multiparae, taken by and large, cannot bear the strain as well as the primiparae, and that the cardiovascular "kick-back," as evidenced by the blood pressure, is 50 per cent that of the primiparae. Although when the whole ampoule was given the systolic pressure showed a mean rise of 16 mm. Hg, and 6 mm. Hg, in the recipients of the lesser dose the diastolic pressure remains constant or plus 4 mm. Hg. On the other hand the diastolic pressure in the primiparae shows a positive change of 9 to 10 mm.

We can readily see that close observation of the diastolic pressure in pregnancy may well prove as important and as imperative as those of the systolic. While the systolic pressure may warn us of an impending kidney or even hepatic calamity, the diastolic pressure may very well forewarn us of a possible cardiovascular catastrophe. The ability of the right heart, the arterial and capillary systems to show a proportionately favorable response to additional extraneous strain will speak favorably for that individual. A poor response, as depicted by the diastolic pressure, may speak ill for such an individual and may early warn us of what that heart may do under sudden stress. This conclusion may prove far-reaching. Many a heart has been declared normal, only to be proved otherwise when it was too late.

UNTOWARD RESULTS

There was one maternal and one fetal death. Case No. 21, Hospital No. 14482 1, bears out the foregoing, quite pointedly:

J. S., aged twenty-six, primipara; admitted Nov. 30, 1930 at 3:30 P.M. Pains irregular, about every ten minutes. Measurements: Intercristal 30, interspinal 27, external conjugate 21, right oblique 24½, left oblique 24, height of symphisis 6, promontory of sacrum not reached, outlet ample. R.O.A.; Fetal heart in right lower quadrant, good quality, rate 130. Cervix was 1½ fingers dilated, membranes intact, head engaged, 1 ampoule of thymophysin was given at 4:15 P.M. The first pain appeared at 4:18, and thereafter pains came every two to three minutes, lasting thirty to

forty seconds, and were fairly strong. Full dilatation was attained at 7:15 P.M., the membranes having ruptured in the meantime, at 4:40 P.M. Delivery of a living infant weighing 10 pounds 13 ounces was effected, spontaneously, at 9:10 P.M., with the aid of an episiotomy. Attempted expression of the placenta was unsuccessful. The cervix, macroscopically, appeared intact. At no time was there undue restlessness, acute pain or severe hemorrhage, although the bleeding was slightly increased after the delivery. The interne, who was doing the delivery, thereupon decided upon immediate repair. While thus engaged, he noticed the patient had gradually gone into shock. All further work was stopped. Her pulse at 10:20, one hour and ten minutes after the delivery, was 116. The general condition was poor, although the pulse at no time went above 116. The placenta had not yet separated. A hypodermoclysis of 1000 c.c. of glucose, intravenous saline, and 10 minims of adrenalin improved the patient's condition. The pulse, however, was still 116, but poor quality. Transfusion was arranged for, but before it could be given she expired.

During her antepartum her blood pressure averaged 102/66. At the time of admission it was 138/78. There were no toxic symptoms. She was obese, with a large, flabby, flaccid overhanging abdomen. There was a systolic murmur at the apex. At 4:10 P.M., just prior to the administration of the ampoule, her pressure was 136/98. At 4:30 P.M., fifteen minutes after the hypodermic, it was 152/102; at 4:35 P.M. 144/100; at 5:15 P.M. 138/90 and at 5:45 P.M. 140/70. The pressures taken immediately before and after administration of the ecbolic show the poor diastolic response, plus 4, and a further study shows an even greater disproportionate drop in the diastolic pressure. Although the systolic pressure returned slowly to the starting point the diastolic dropped rapidly and consistently far below the original. This seems to indicate a cardiovascular weakness, whether of the right heart or the capillary system or both is yet to be determined. Evidently the strain was too great and it is probable that the sudden removal of the intra-abdominal pressure caused the concommitant collapse, and not a ruptured uterus.

Fetal Mortality:

Mrs. A. S., No. 55, Hospital No. 14464 I, aged thirty-seven, obese, gravida 10, para 9. Previous deliveries spontaneous. Admitted Nov. 29, 1930, at 1:10 A.M. Measurements were: intercristal 29; interspinal 26; external 21; promontory of sacrum not reached; bisischial ample. L.O.A. Cervix 2½ fingers dilated. Half ampoule of thymophysin was given at 8:25 A.M. First pain appeared at 8:35 and thereafter at regular intervals of five minutes, lasting twenty seconds. Blood pressure prior to the administration of the oxytocic was 168/100 and fifteen minutes after 172/108. At 3:05 P.M. on a check by the attending obstetrician, a frank breech presentation was disclosed, L.S.A. Fetal heart was good, 144. Vaginal examination at 6 P.M. revealed no progress. The fetal heart 180. In the interest of the child, extraction was performed without difficulty. Notwithstanding this, the child was born in asphyxia. All attempts at resuscitation failed.

Several features were evinced in this fetal death, any one of which or all may have been the causative factor. Among these were the unrecognized breech, the addition of insult to injury by administering an oxytocic, and the late interference in the delivery. Thus we have 2 mortalities, one maternal and one fetal, in cases wherein thymophysin was used; the maternal was perhaps excusable, the fetal not.

SUMMARY OF FINDINGS

1. Sixty-five cases were taken for the purpose of studying the physiological behavior of thymophysin in pregnancy. Three of these have been deliberately omitted, inasmuch as the ecbolic was given with the idea of inducing labor at term.

2. It was found that thymophysin stimulated rhythmic, uterine contractions in 2.7 to 5.9 minutes in the multiparae and in 4:25 to 5 minutes in the primiparae.

3. These pains thereafter, recur rhythmically, in the multiparae every 1.6 to 2.77 minutes, and in the primiparae every 2.5 to 3.25 minutes and 2.8 to 3.6 minutes, depending upon the dose.

4. They last from 24 to 45 seconds in the multiparae and 33.1 to 57.9 seconds in the primiparae.

5. Depending upon the dose, full dilatation is attained in 3 and $^{36}/_{60}$ hours in the multiparae and from 5 and $^{12}/_{60}$ hours to 6 and $^{54}/_{60}$ hours in the primiparae.

6. There is a definite increase in the blood pressure, irrespective of the dose. The full ampoule giving rise to an average mean systolic of 16 mm. Hg, in all classes and 9 to 10 mm. Hg, diastolic in the primiparae. While the mean diastolic pressure in the parous groups, irrespective of the dose, rose only 4 mm. Hg. The systolic pressure in the half ampoule multiparae class rose only 6 mm. Hg.

7. It appears then there is a distinct loss in the cardiovascular reserve for the multiparae.

8. The half ampoule in the parous groups accomplishes its work as satisfactorily as the whole, with less danger to the right heart.

9. There was one maternal death due possibly to cardiovascular failure.

10. There was one fetal death, in an abnormal position (L.S.A.). Death here may have been due to a complicity of causes.

11. Although of no direct bearing upon the study of thymophysin in pregnancy, the incidental disclosure of a definite loss in the "kick-back" power of the right heart and the vascular system in the multiparae, may if proved correct, be of value in other branches of medicine.

CONCLUSION

From the foregoing study, we may formulate the following conclusion:
Thymophysin should not be used:

1. Where labor is progressing rapidly and satisfactorily.
2. Where the cervical dilatation is four fingers or over and progress is being made.
3. Where the simple expedient of rupturing of the membranes is sufficient.
4. Where any malposition exists. We used thymophysin in one case of breech presentation which we now think was a mistake.
5. Where the cardiovascular competency of the patient is uncertain.
6. And finally, having thus narrowed the field for the clinical employment of thymophysin, we believe it should have a place in the obstetrical armamentarium of the trained obstetrician, although his use of it might well be restricted to the hospitalized patient, until such time as its true physiological action is better understood.

I wish to take this opportunity to thank Dr. Harvey B. Matthews, Director of Obstetrics at the Coney Island Hospital, for his permission to carry on a part of the work at this institution and for his constructive suggestions in the preparation of the paper.

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PELVIMETRY

SOME GENERAL CONSIDERATIONS

HERBERT THOMS, M.D., F.A.C.S.

NEW HAVEN, CONN.

"VERY many be the perils, dangers and throngs which chance to women in their labour," wrote Thomas Raynalde in 1634. Today these words of the author of the first book in Obstetrics in the English language do not sound strange nor are they out of date. Dangers in childbirth may be said to be divided in general into three etiological groups, namely dangers associated with toxemia, with infection and with mechanical difficulties. It is with this latter group that this paper is interested and my purpose is to emphasize once more the great importance of a fundamental knowledge of the mechanics of labor for those who endeavor to practice scientific obstetrics. I am convinced that the adoption of this concept is an urgent need in our present obstetrical teaching and that he only is great as a teacher who is fundamentally a master of clinical obstetrics.

"Fortunate it would be indeed for child-bearing women," wrote Ramsbotham in 1855, "if they each possessed a pelvis of the figure and dimensions already given as standard. Such however is by no means the case; and this organ is subject to great varieties, as well in form as size. It would indeed be difficult to select from all the preserved specimens in existence any two which exactly resemble each other." Nearly a half century ago Sir William Turner said "with the exception of the skull no portion of the skeleton presents greater individual variations than the pelvis."

These variations may have a profound effect upon the course and character of labor as is well known to obstetricians and the pronounced types of contracted pelvis are well known and readily recognized. On the other hand there are many slight or moderate variations from normal which remain unrecognized. This latter group may also exert a powerful influence on labor. In most instances these moderate variations do not form an insuperable obstacle to labor by the natural passages, yet on account of this very fact their importance may be minimized and their role as a factor in labor pathology become very great. That the importance of a knowledge of certain phases of the mechanics of labor is underestimated is witnessed by the relatively scant attention given in most modern textbooks on Obstetrics to the subject of contracted pelves. A noteworthy exception is found in the textbook by Whitridge Williams. This author not only appreciated the fundamental importance of the subject, but was himself a noteworthy contributor to this phase of our science. Not only in textbooks, but in the literature itself we find a lack of proper attention. This seems wholly inconsistent with the advanced methods of diagnosis which we possess at the present time. For instance one reads voluminous accounts concerning the treatment of occipitoposterior position but hardly a word of investigation as to the cause of this abnormality.

When we consider the additions in recent years to our knowledge of labor mechanism it is surprising how little information we possess that was not known by the obstetricians of two generations ago. It would appear that from that time to the present almost the entire attention of investigators has been absorbed by the development of more recent fields of investigation. However important such contributions may be, no impression must be created that the mechanical factors associated with childbirth are wholly understood and that this phase of the subject is in general worked out. It is by no means a closed book nor will it become so while the toll of morbidity and mortality

due to mismanagement of labor remains in its present high state. There is but little question but that a large proportion of untimely and ill-advised obstetrical operations are due solely to a lack of the proper understanding of the mechanical aspects of labor which includes not only a knowledge of the size and shape of the bony pelvis, but the size of the fetus, the course it must take, and the forces which impel it through the birth canal.

The oft-quoted dictum that "the best pelvimeter is the baby's head" may be a useful idea, but to establish diagnosis and treatment on any such rule of thumb method is neither safe nor scientific. The fact that most women will deliver spontaneously if left alone is also very useful information, but the use of the so-called "test of labor" as a substitute for scientific diagnosis is a most dangerous policy.

It would appear to me that one of the important modern aids to obstetrical diagnosis has been the development of means of accurate mensuration of the bony pelvis. I refer in particular to roentgenometric mensuration of the superior strait and basing my conclusions on an experience now extending over twelve years I am more and more convinced of the inadequacy of external pelvic measurements as an index to the size and shape of this important plane. Time and again has it been proved to me that external measurements are not only unreliable, but often misleading. We can stand firm on the proposition that if pelvimetry has any place at all in obstetrical procedure then *accurate* pelvimetry must be employed. At the present time there are a number of methods of roentgen pelvimetry which will give accurate results. Some of these are based on roentgen stereoscopy. The method which I have described and which we use is simple, rapid and accurate and appears adequate for every obstetrical purpose. It does possess two distinct advantages which seem to me essential, one is that the film may be viewed without a viewbox and the measurements directly read, and the other is that it is possible to easily produce a graph of the superior strait in its true proportions which may be incorporated with the prenatal record.

It appears certain to me also that the use of roentgenometric methods of diagnosis in pregnancy is bound to be of greater usefulness than to furnish exact mensuration of the superior strait of the pelvis. Such methods make possible a study of human constitution applied to obstetrics which should be of distinct scientific value. If we consider the intimate relationship of the pituitary to pregnancy and labor we are bound to conceive an idea as to the importance of correlating human growth types to the entire study of reproduction. Of course the question has been raised as to whether a great homogeneous population would lend itself to a system of classing or grouping from a structural standpoint. From the point of view of obstetrics I think such studies are fraught with results of considerable value. As an illustration it can be stated that obstetricians of experience for a long time have been conscious of certain structural types of individuals who appear to be definitely associated with certain types of labor. Indeed within a few months a contribution has appeared with the suggestive title "The Dystocia Dystrophia Syndrome Patient." It would appear that roentgenometric methods of diagnosis will be of exceptional value in such studies.

As to the application of these methods to obstetrical diagnosis I am definitely of the opinion that the roentgen pelvimetry of every primiparous woman will have a great two fold benefit, first a very great value to the individual and secondly a noteworthy addition to our knowledge of the variations of the pelvis. At the present time until we establish by exact roentgenometric methods normal standards we can never accurately appreciate the pathologic or abnormal.

[Concluded on p. 445.]

APPENDICITIS IN PREGNANCY*

WILLIAM B. MARBURY, M.D.

WASHINGTON, D. C.

APPENDICITIS in pregnancy has created but slight interest in this country. Over two-thirds of the articles and reports on this subject are from the foreign literature. Such cases are usually seen only at large obstetrical clinics. The subject has been ably reviewed by Babler in 1908 and Wilson in 1927.

In 1848 Hancock successfully drained a perityphlic abscess ten days after labor. Munde, 1894, described the first case of appendicitis in pregnancy, which terminated successfully after operation. At that time, Munde reported that no earlier cases were to be found. In 1897 Abrams reported 15 cases from the literature and Boige in 1901 found 70. Since then many cases have been reported, but relatively few, occurring during the last two months of pregnancy.

Primary acute appendicitis occurs probably no more frequently in pregnant women than in non-pregnant ones. On the other hand, pregnancy is likely to cause an exacerbation of a previously pathological appendix. Findley reports 15 cases in which all but one had had previous attacks of appendicitis, and believes that exacerbations of previous attacks may be expected in about 70 per cent. Felkner says that only one out of 3800 known cases of appendicitis escaped a return of the trouble during pregnancy. DeLee remarks that in over thirty years of obstetrical practice, he has seen only 4 cases of appendicitis late in pregnancy. Over 80 per cent of the reported cases occurred during the first six months, while actually very few during the last three months.

The mortality is striking. Schumacker gives it as between 30–50 per cent, and where peritonitis is present, 80 per cent. Dworzak states that the mortality varies between 18.1 and 76.9 per cent, depending upon the stage in which the patients are referred for operation and the method used, and adds that the infant mortality approaches 100 per cent. Babber pertinently remarks that "The mortality of appendicitis complicating pregnancy is the mortality of delay." It has improved markedly in the last ten years.

SYMPTOMS AND DIFFERENTIAL DIAGNOSIS

Appendicitis during the first four months of pregnancy presents the same symptoms as the average case of appendicitis, namely, right lower quadrant pain and tenderness, muscle spasm, nausea, vomiting, fever, and leukocytosis. After the sixth month, other factors arise to confuse the diagnosis.

The first of these is the constant pressure contraction of the uterus that may occur as result of appendicitis, and be severe enough to similate the onset of labor. It is largely this symptom that makes it almost impossible to diagnose appendicitis after labor begins and partially accounts for so few cases having been reported.

The other deceptive factor is the displacement of the abdominal viscera by the growing uterus. The appendix is pushed up almost to the level of the gall bladder. Pain from a pathological appendix in this area would be exceedingly difficult to distinguish from that produced by an inflamed gall bladder, a pleurisy, a renal colic or even a duodenal ulcer. Futh and Obladen found an upward displacement of the cecum after the fourth month, which Schumacher confirmed by *x*-ray in 70 women, examined from the second month to the end of pregnancy. In the latter months, he found the ileocecal junction close to the liver and displaced laterally. The attenuation and thinning of the abdominal muscles is likely to minimize muscle spasm. Appendiceal pain must be sought at progressively higher levels as the months of pregnancy pass by.

* Read before the Southern Surgical Association, White Sulphur Springs, Va., Dec. 9, 1931.

Pyelitis on the right side is the most frequent cause of error. It can coexist with acute appendicitis and should be either ruled out or definitely determined by ureteral catheterization. Other conditions that may cloud the picture and have to be excluded are salpingitis on the right side, tumors of the adnexa, ovarian tumors with twisted pedicle, criminal intervention, intestinal obstruction.

TREATMENT

There is little divergence of opinion among authors as to early operation when the patient is seen during the first six months of pregnancy. After this it is not only a surgical but an obstetrical problem as well, and since we face a mortality of between 18 and 70 per cent, there is small wonder that there is less agreement.

In the seventh month there are less apt to be obstetrical complications and most cases can be cared for as in the first six month period. During the last two months the treatment depends upon the stage at which the patient is referred for operation. If unruptured, the appendix can be removed through a simple McBurney incision and the chances of aborting are slight.

If there is localized abscess the same procedure may be followed but there is much greater chance of abortion, and herein lies the danger. If abortion occurs the change in the size of the uterus breaks up what protective adhesions have formed and allows the peritonitis to become generalized. Consequently it may be wiser to make a paramedian incision and empty the uterus by cesarian section first and deal with the appendix secondarily. This permits the operator to determine the degree of soiling after the uterus has contracted and make a more definite and permanent toilet of the abdomen.

Where generalized peritonitis is revealed at the time of exploration, infection of the endometrium is inevitable. Under these conditions, Hirst, Conrad and Wilson believe that the Porro operation, with removal of the uterus, is indicated. DeLee is against the classical cesarian section for fear of infecting the uterus and believes that in the presence of pus, it is better surgery to remove it. Vaginal delivery is not suitable here on account of the inevitable loss of time except where the attack is coincident with the second stage of labor.

In the puerperium, appendicitis is likely to be mistaken for "after pains," retained secundines or puerperal fever. Hilton reports 12 cases of the perforative type operated on, with 4 deaths.

This paper was prompted because of a recent case that typifies some of the difficulties of early diagnosis and illustrates the advantages and justification of operating on meager clinical and laboratory findings.

Mrs. R. P., twenty-four years old, South African by birth but of English descent, was seen in consultation at Columbia Hospital, August 7, 1931. Her previous pregnancy had been stormy as was her present one. Most of the first six months had been spent in bed because of pernicious vomiting and on both occasions interruption of pregnancy had been seriously considered. On the day of the onset of her illness she went down town to do some last minute shopping in expectation of her confinement in about a weeks' time. While in the elevator of the department store she felt some pain in her abdomen and became nauseated. On arriving home her husband gave her some soda and later a mild laxative which she vomited. The pain continued but was not of a particularly severe character and in the evening her temperature was 100.2°F., leucocyte count 14,000. I saw her about 8 P.M. at the hospital at which time her temperature was 99.4°F., leucocyte count 11,650 and polymorphonuclears 89 per cent. A catheterized specimen of urine showed no pus. Pelvic examination revealed nothing abnormal. At this time she was fairly comfortable when lying still but was tender on palpation in the right flank above the anterior superior spine of the ilium. There was very little muscle spasm. The patient complained mostly of the movements of the baby saying that "It kicked her in the sore place." Her past history was irrelevant except that she admitted having had several attacks of "indigestion" with twinges of pain in the right side. These had

always subsided with rest and modifications of her diet.

The question was clearly whether to advise for or against operation. Dr. Mundell, who had cared for her in her previous pregnancy, advised me that the temperature and leucocytosis could be easily accounted for by the pregnancy. Labor was expected in the next ten days. Could these be premature labor pains? But what of those previous attacks of mild "indigestion" and the acute onset, plus the tenderness in the flank on deep palpation? Realizing the mechanical difficulties of operating under those conditions but fearing more to err on the conservative side, an operation was advised.

Operation. Under avertin and gas anesthesia a high muscle splitting incision was made with the opening into the peritoneal cavity well above the anterior superior spine. Both the transversalis fascia and peritoneum seemed thickened. The cecum could not be located as the uterus crowded everything out of the way. Something was picked up which at first appeared to be the appendix but was the fallopian tube. A higher transverse incision was made through the fibers of the internal oblique to avoid cutting across the muscle between the two openings. Still no gut was visible but with a pair of long tissue forceps, a piece of the cecum was brought into view. No effort was made to displace the uterus. The appendix was then located and found to be swollen, acutely inflamed and covered with fibrinous exudate. It was removed with some difficulty and the stump turned in. The two transverse wounds in the internal oblique were closed independently without drainage.

Her convalescence was marred by constant vomiting during the first three days, relieved only by the stomach tube. On the fifth day she developed a right-sided parotitis which owing to her already weakened condition proved to be a serious complication. This was followed by a facial paralysis. On August 26, nineteen days after admission, she gave birth to a normal full term baby weighing 6 pounds, 5 oz. Two weeks later she was discharged in good condition, the complications having cleared up spontaneously.

Whereas the foregoing case does not sound thrilling when recounted now, it might have been, had the appendix been allowed to remain for another twelve or twenty-four hours. I have reported it at some length to emphasize on what a thread of evidence the decision in favor of an operation hung and how indefinite both the symptoms and physical findings can be at a time when the greatest good can be expected by operation.

DISCUSSION

In considering how appendicitis in pregnancy differs from appendicitis at other times, it is necessary to picture what goes on in the abdomen during this period. After the sixth month, the intestines and omentum are gradually pushed upward until in the last trimester they are in the upper part of the abdomen and considerably more cramped. The cecum, unless it is fixed, shares in this ascent and compression. Any adhesions that may have formed are broken up. If suppuration occurs the uterus is apt to form part of the wall of the abscess and crowd the omentum out of the way. Pus in this position is more dangerous than in the lower part of the abdomen because of absorption. The heavy pendulous uterus will change its position when the patient moves or turns, even in bed, and so the abscess may be broken and the infection extended. There are no loops of intestines to help prevent its extension but only the smooth uterine wall that pus can spread along to the pelvis. One factor that may play a part in the extension of the infection is the position of the child. In the case reported, the patient complained most when the child was active, saying that he kicked her in the side. This would have a tendency to act in the same way as a cathartic. During parturition the conditions mentioned are even more exaggerated since at this time the excursions of the uterus are greatest. With the ascent of the uterus, the adnexa and appendix are brought into closer proximity. Infection in either may cause a corresponding inflammation in the other by contiguity.

Constipation has generally been considered as a predisposing factor in appendicitis. It is the rule in pregnancy and may

largely account for the acute exacerbation that occurs at that time.

Localized tenderness is probably the only symptom that appendicitis does not share with other pathological conditions. Both temperature and leucocyte count are unreliable. During pregnancy a leucocyte count less than 13,000 means very little. Ochsner is credited with the remark that he always got a leucocyte count in suspected appendicitis but never looked at it until after the operation.

The question as to the choice of incision is not inconsequential. The right rectus gives more room for exploration but is of doubtful advantage where most of the

TABLE 1

No.	Year	Author	Months of Preg.	Previous Attacks	Time of Op. After Onset	Condition of Appendix	Aborted	Infant	Mother
1	1909	Jones	7		24 hrs.	perf.	after op.	D	D
2	1910	Delbet	9		non-op.	perf.	4th day	R	D
3	1912	Findley	9	yes		gang. perf.	after op.	D	D
4	1913	Dorset	7½	yes		gang. perf.	after op.	D	D
5	1913	Dorset	8		36 hrs.	abscess	before op.	?	D
6	1914	Binet and Job	9		4 hrs.	simple	after op.	R	R
7	1915	Wallace	9		2nd day	perf.	after op.	R	R
8	1919	Grattan	9	No	2nd day	gang.	no	D	R
9	1916	Tate	7	yes		acute	no	R	R
10	1920	Cocke and Mason	7	yes	66 hrs.	gang.	cesarian	D	R
11	1921	DeLee	9		18 hrs.	simple	no	R	R
12	1921	DeLee	8½		30 hrs.	gang.	after op.	R	R
13	1921	Sexton	7			gang.	no	R	R
14	1921	Buford	7	yes		gang.	no	R	R
15	1921	Buford	9	yes	4th day	perf.	after op.	D	R
16	1924	Reeb	7			gang. perf.	after op.	D	R
17	1925	Ficklen	7½	yes	3rd day	gang.	after op.	R	R
18	1925	Hispley	8	yes	24 hrs.	gang. perf.	after op.	D	D
19	1925	Barber and Miller	9		18 hrs.	simple	after op.	R	R
20	1926	Lemeland	8		48 hrs.	gen. periton.	before op.	D	D
21	1926	Risacher	8		4th day	simple	cesarian	R	R
22	1927	Phaneuf	7		48 hrs.	gang. perf.	after op.	D	D
23	1927	Phaneuf	9		2 hrs.	simple	no	R	R
24	1927	Wilson	8½	yes	48 hrs.	gang. perf.	cesarian	D	R
25	1928	Conrad	9			perf.	vag. cesar.	D	D
26	1929	Masse and Riviere	7		1st day	acute	after op.	D	R
27	1929	Dworzak	7		7th day	periton.	after op.	D	R
28	1929	Muller	7	yes	3rd day	abscess	no	R	R
29	1929	Cotte and Heitz	7½			gang. perf.	cesarian	R	R
30	1929	Downing	8½	yes	60 hrs.	gang.	after op.	D	D
31	1929	Liek	7		5th day	perf. periton.	before op.	D	R
32	1930	Bohler	8½		3rd day	gang. perf.	after op.	R	R
33	1931	King	9		36 hrs.	gang. perf.	cesarian	R	R
34	1931	Marbury	9	yes	8 hrs.	acute	no	R	R
								D = 16 R = 17	D = 10 R = 24

SUMMARY OF TABLE 1

		Infant died	Mother died
Total cases of appendicitis in pregnancy since 1908 reviewed	364		
Cases occurring during 7th, 8th, 9th, month	34		
Of these: Mother died	10 (26.4 per cent)		
Infant died	16 (47.0 per cent)		
Simple appendix	7		
Gangrenous or perforated	27		
Delivered at term	5	0	0
Cesarian section	5	2	2
Vag. cesarian section	1	1	1
Aborted	23	13	9

abdomen is obscured by the uterus. Traction is necessary which in all probability will induce labor. Postoperative ventral hernia is more likely to follow than in the muscle-splitting incision. If drainage is necessary the situation is less advantageous and even if this is done through a stab wound in the flank, infection of the wound is likely to occur. All these are minor considerations, however, as compared to the degree of contamination. Through the rectus incision it is necessary to work through clean intestines to get to the dirty ones, whereas through the McBurney incision, the abscess is partially walled off by the parietal peritoneum through which it is approached. By this approach it is often possible not to disturb the protective barrier on the medial side of the abscess. There is this about the McBurney incision: it is not adequate in case of a mistaken diagnosis or for exploration. The operator must be willing to pocket his pride in a certain number of cases (fortunately few) and make another incision. Even so no harm has been done.

CONCLUSIONS

Every obstetrical patient should be questioned concerning abdominal discomfort with special reference as to the appendix. In doubtful chronic cases a barium meal followed by *x*-ray is helpful.

In non-suppurative cases during the first six months the outlook for both mother and child is excellent. Later the mortality increases directly as the duration in months of the pregnancy and duration in hours of the appendicitis. Pregnancy is not an etiological factor in primary appendicitis but tends to cause recurrences where a pathological condition already exists.

Motion of the infant and the sag of the pendulous uterus are definite obstacles to the formation of adhesions and partially account for the frequency of generalized peritonitis.

Early operation is the greatest factor in lowering mortality. Too much dependence cannot be placed upon a moderate temperature and leucocyte count, as these may give a false sense of security.

A careful history, especially with reference to previous attacks, is of inestimable aid.

The direct approach through a muscle-splitting incision is advocated in non-suppurative cases. In the presence of generalized peritonitis a cesarian section should be done, followed by the removal of the uterus, as in the Porro operation.

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[For Remainder of References see p. 452.]

MYOSARCOMA OF THE STOMACH*

REPORT OF A CASE

C. R. EDWARDS, M.D., AND R. B. WRIGHT, M.D.

BALTIMORE, MD.

WHILE sarcoma of the stomach is a rare disease, it is probably more common than a review of the literature would indicate. Ewing[4] says that about 1 per cent of gastric tumors are sarcomata, while Fenwick[6] places the percentage at 5 to 8. Unlike carcinoma, sarcoma is about equally divided between the two sexes. Sarcoma of the stomach is most common between forty and fifty years of age, to which decade 24 per cent of all cases belong (Konjetzny[7]).

For a discussion of the etiology, histogenesis and clinical aspects of sarcoma of the stomach, reference is given to D'Aunoy and Zoeller,[3] where this has been adequately treated.

FIG. 1. Schematic drawing of tumor in situ. *b*, Urinary bladder. *c*, Colon. *s*, Stomach. *t*, Tumor mass.

Myosarcoma of the stomach is much less frequent than lymphosarcoma, to which group most sarcomata of this organ belong. Ziesche and Davidsohn[10] list 20 cases of myosarcoma of the stomach; the first two were reported by Virchow in 1862 and the last two by Kaufmann in 1907 and 1908. D'Aunoy and Zoeller collect 13 cases reported from 1914 to 1930 and add one case of their own. To this there may be added one case from the Mayo Clinic (there were 3 cases reported by Balfour and McCann[2] but two of them were included by D'Aunoy and Zoeller). Antonow[1] and Schiff and Foulger[9] each report a case. Farr[5] in 1926 reported a case of spindle cell sarcoma of the stomach. From the author's statement and from his description it seems probable that the tumor was of muscular origin. Including Farr's case we have been able to find 38 reported cases, although as Ewing points out "there is little doubt that some or

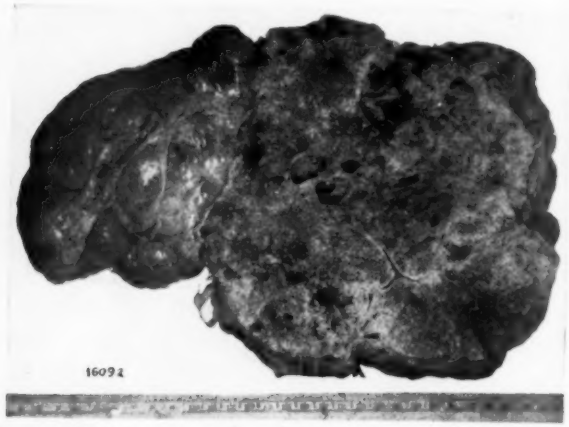

FIG. 2. Gross tumor after fixation. Surface shows large translucent areas of degeneration, dark areas of hemorrhage and cyst-like spaces. Nodular arrangement is well shown.

* From the Departments of Surgery and Pathology, University of Maryland School of Medicine.

many of the so-called large round cell sarcomata are of muscular origin."

Myosarcoma of the stomach commonly

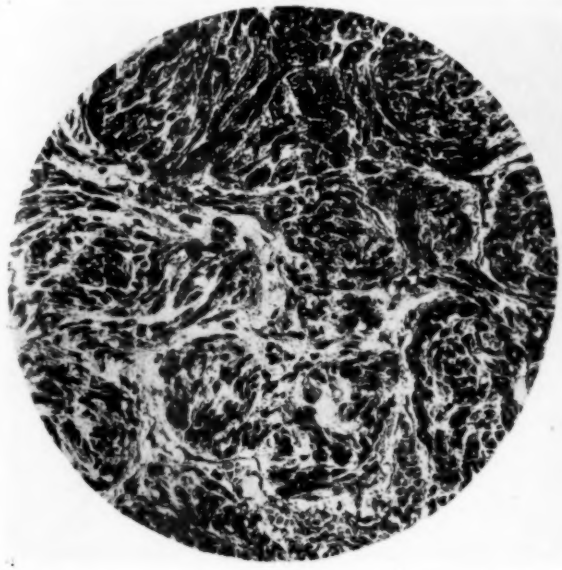

Fig. 3. Low power of tumor showing interlacing of cells.

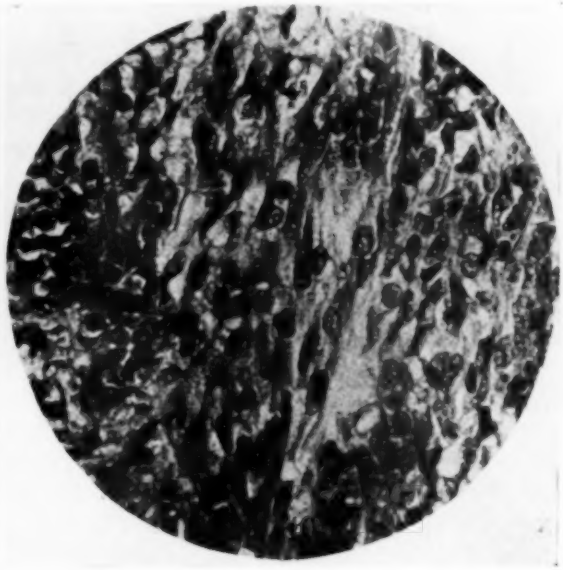

Fig. 4. High power of tumor to show cell form.

arises from the curvatures and often projects into the peritoneum as a solitary solid or cystic tumor. They are not infrequently attached to the stomach wall by relatively small pedicles. This type of tumor is the largest encountered in the stomach. McWhorter[8] reported a mixed round and spindle cell sarcoma of this viscus which weighed 18¾ pounds. In the case herewith reported the tumor weighed 13 lbs. 10 ozs.

The structure of myosarcomata varies; in some instances the cells are distinctly muscular in type, while in other cases the predominating cell may be of a large spindle form. The cells are arranged in interlacing bundles and often the combing effect is characteristic.

The following case is reported because of the interesting clinical aspect and because of the size and rarity of the tumor:

Mrs. E. F., a white married female, aged sixty-eight, presented herself on February 7, 1928, complaining of a large tumor in the abdomen, some indigestion and constipation. She noticed a lump in the lower left quadrant about July, 1926. It gradually enlarged, grew downward and projected forward until the tumor filled the entire abdomen. Its size and weight made it impossible for her to be comfortable except in the erect position.

In August, 1927 she was operated upon by another surgeon who, when he found how extremely vascular the tumor was, closed the abdomen, making no attempt to remove it. Later she was given *x*-ray treatment but without benefit.

Examination shows an extremely well preserved, moderately thin woman who appears younger than her years indicate. The abdomen is much enlarged, being equally as large as the average full term case of pregnancy. The maximum enlargement is in the upper abdomen and the mass projects directly forward. The abdominal wall is mobile over the tumor and the latter is firm, elastic and nodular. The patient was admitted to the Maryland General Hospital on February 7, 1928, and an *x*-ray examination was made after a barium enema. It showed the colonic flexures normally situated but the transverse colon had been pushed into the pelvis below the tumor and was not visible in the *x*-ray. It was now apparent that a tumor originating in the upper abdomen, displacing the stomach upward and the colon downward had to be considered. The blood Wassermann reaction

was negative, leucocyte count 7200, with a normal differential count, blood urea 42.2 mg. per 100 c.c. and urine negative.

Regardless of the disappointment incident to a laparotomy performed six months before, the patient was in great distress and very anxious to have something done. Therefore, on February 11, 1928, she was subjected to operation. Under nitrous-oxide gas anesthesia the abdomen was opened by a long midline incision. Numerous extremely vascular contact adhesions were found loosely binding the tumor to the abdominal wall. These were divided between clamps, and the intestines which were similarly adherent to the tumor were freed and bleeding points ligated. The tumor was now found to be free posteriorly and to originate by a pedicle from the inferior surface of the greater curvature of the stomach, involving, however, only a small section of the stomach wall. The stomach was doubly clamped above the pedicle of the tumor and divided between clamps. The wound in the stomach was closed with continuous chromic catgut sutures. Her abdomen was then inspected for metastases but none was found. All hemorrhage was arrested and the abdomen was closed without drainage. The patient was slightly shocked but soon recovered and made an uneventful convalescence.

At the end of two weeks the patient returned to her home and was very comfortable for about four months; then she noticed a lump in the right abdomen.

This tumor grew rapidly and she returned on July 24, 1928, five and one-half months after the removal of the primary tumor. She had gained considerably in weight, her color was good, and there was no evidence of cachexia.

Examination of the abdomen revealed a large mass on the right side projecting from beneath the ribs and extending into the pelvis on the same side. There was also a nodule in scar of previous operation about 1.4 cm. in diameter which was regarded as an implantation metastasis. The tumor in the abdomen was diagnosed as a metastasis into the liver. The patient was informed of her condition and advised that further surgery was useless. She insisted, however, on an operation, stating that the previous operation had been done without optimism. Therefore, on July 25, 1928, her abdomen was opened and a huge metastasis into the liver was found. The nodule was removed from the abdominal wall. No glands or other intra-abdominal metastases were found. The wound in the stomach had healed perfectly. The patient was discharged from the hospital two weeks later and returned to her home, where for three or four months she remained in bed. Following this, however, her condition was variable and not until July 1, 1930, did she become totally disabled by a condition of anasarca and she died September 1, 1930, two years, six and one half months after the primary tumor had been removed.

Gross Specimen: The tumor mass (S.P. 16092) immediately upon its removal measured 37 × 23 × 16 cm. and weighed 13 lbs. 10 ozs. (6180 gm.). The tumor is covered by peritoneum which dips down in narrow deep sulci which make the surface irregular and give it a distinctly nodular appearance. At a point near the lower pole there is a large piece of omentum attached. Under the peritoneum many large vessels can be seen. At the upper pole there is a piece of gastric mucosa roughly circular and measuring 5.5 cm. in diameter.

This represents all the gastric wall that was removed. The tumor is attached to this piece of gastric wall by a very short stalk about 4.5 cm. in diameter. There are three small ulcers in this piece of the gastric mucosa. In the gross it can be distinctly seen that the pale greyish tumor tissue extends to the gastric mucosa, which, except for the small ulcers, extends uninterrupted over the tumor tissue. On the cut surface the nodular arrangement is very evident with deep sulci which pass one-third of the distance through the mass. In some places there are numerous large, irregular, dark brown areas which are the result of old hemorrhages. After the tumor is cut across, fluid escapes from small cyst-like structures which have irregular smooth walls and do not appear to have a definite lining. In certain cysts the content is coagulated and, therefore, remains when the cyst is opened.

Microscopic Examination: Sections of the gastric wall at the point of attachment to the tumor stalk show normal mucosa except for the small ulcers, the bases of which are composed of necrotic and tumor tissue. There is no infiltration by wandering cells. In some places the tumor extends to the mucosa but in most places it is separated from the mucosa by the submucosa. As the normal muscular coat is followed, a point is reached where the muscle gives way to or changes to tumor. At

this point one can see in a single high power field both the normal muscle and the tumor.

The best preserved portions of the tumor are composed of large spindle cells (average size of nuclei 14.5 × 4.5 microns) arranged in intertwining bundles. The nuclei are elliptical and have chromatin so distributed as to give a coarse granular appearance. No mitotic figures are found. The cystoplasm of one cell passes imperceptibly into that of a closely adjacent cell so that no cell margins can be made out.

There are large areas of degeneration where the tissue is a homogeneous pink with some dark brown masses of pigment which gives the ammonium sulphite reaction for iron. Vessels are numerous. The degeneration sometimes extends so that even the vessel walls themselves appear to be devoid of nuclei. Such degeneration probably explains the hemorrhage, which, in some places, is very extensive.

Sections of the nodule found in the scar of the second operation show a very cellular mass made up of spindle cells similar to the cells described above in the primary growth.

SUMMARY

The case herewith reported is of interest because it is the largest myosarcoma of the stomach that we have been able to find and because of the good result following operation on a tumor that had previously been pronounced inoperable.

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CONCLUSION OF DR. THOMS' ARTICLE*

If we consider that almost our entire knowledge of pelvic variations is based on the study of postmortem specimens we realize the present importance of studying pelves in the living. This is the only way that we may properly correlate such pelves to the course of labor. Before the advent of roentgenometric methods obviously it was impossible to make accurate studies of this character. It may be said in fact that the only plane of the pelvis which lends itself to satisfactory external mensuration is the pelvic outlet and because of this our knowledge of the effect of certain pelvic variations here has been developed to a very useful degree. The acknowledged importance of the pelvic inlet in relation to the course of labor clearly points to the necessity for the acquisition of accurate knowledge of that relationship.

When external pelvimetric methods in obstetrics were established an important step in the progress of that science was made. The fact that such methods have proven useful in spite of their frequent inadequacy is a conclusive argument for accurate roentgenometric technique. Therefore if the ordinary external pelvic measurements are serving any useful purpose, roentgenometric methods of pelvimetry will prove to be of infinitely more value.

* Continued from p. 436.

COMPARISON OF

THE ANATOMICAL, THE CLINICALLY NORMAL AND THE PATHOLOGICAL STOMACH*

ADDISON G. BRENIZER, M.D.

CHARLOTTE, N. C.

WE, as surgeons, are impressed by a comparison of the configuration of the stomach as we studied it in the dissecting room and as is described in Gray's "Anatomy" and as we see it at operation and, on the other hand, as we observe it in fluoroscopic examinations and in *x*-ray pictures and, finally, as altered by pathological lesions and operations. We are not infrequently startled at the compensated function of the stomach so changed in its outline.

We may accept Alvarez's[1] statement: "that (primarily) rhythmic contraction must be a property of muscle and muscle-like tissue, and the probability is that it (contraction) is brought about simply as a result of recurring cycles of chemical activity." But, in the intact animal, we are aware, from our knowledge, of the existence of two elaborate plexuses of Auerbach and Meissner, ganglia and nerve connections and know that the nerves and muscles must work together. At the same time, we are constantly surprised at the compensation in function when not only these nerve connections, but muscle continuity is interrupted by resections.

There is a normal anatomical interruption or block between the stomach and duodenum, almost complete, of the circular muscle fibers, partial of the longitudinal fibers; almost complete of the arteries and lymphatics; on the other hand, the myenteric and submucous plexuses are connected with each other and the myenteric plexus is continuous from stomach to duodenum (Horton[2] and Williams[3]).

Clinically, we must still think of the stomach as a whole, and not merely as a muscular apparatus, even though the detached stomach may show its characteristic motility, but, as a musculoneural apparatus, with its characteristic blood and lymph supply.

Cole[4] points out that the living, functioning, partly-filled stomach with the patient in the erect posture varies widely from the dead stomach observed with the subject supine, the pyloric end, contracted in rigor mortis, and the corpus and fundus over-distended with gas. The one is spoken of as the "clinical stomach" in counter-distinction to the "anatomical stomach." Gray described this "clinical stomach," but made no effort to illustrate it.

Cole has made a study of *x*-ray pictures of the lumen of the living, functioning stomach, compared with necropsy and surgical specimens, preserved so as to prevent the deformity which takes place after death, and has drawn and described morphologically the "clinical stomach" of Gray. When the exterior of the stomach is looked at, there is no decided line of distinction seen, even between the antrum and the cap. However, during certain stages of the gastric cycle, the stomach is separated into four chambers: the fundus, the corpus, antrum and cap, by three constrictions; the pyloric valve, the sulcus angularis and an ill-defined line between the corpus and the fundus, the corporic shelf.

Conspicuous landmarks on the outside of the stomach are a large vertical column and a smaller oblique column; the adjacent sides of which form the apex of an angle, which is the incisura angularis. From the incisura angularis is a mucomembranous fold, projecting into the bismuth shadow,

* Read before the Southern Surgical Association, White Sulphur Springs, W. Va., December 9, 1931.

which is not seen on the outside of the stomach and which Cole has proved by measurements not to embrace the muscle layer, since there is space for only two layers of mucosa, muscularis mucosae and a core of submucosa.

There is a confusion of terms between the surgeon and the roentgenologist. The landmark of construction and the ring between the pyloric antrum and duodenum, which the surgeon sees or feels at operation or autopsy is, indeed, indefinitely the "pyloric orifice," but is not the "pyloric valve"; what he feels is the circular musculature around the pyloric canal. The pyloric valve, like the sulcus angularis, is a fold of two layers of muscularis mucosae and mucosa. The circular muscle fibers do not project down into this fold. The pyloric valve is made evident when the circular muscles of the pyloric canal are relaxed. When the circular muscles contract to form the pyloric canal, the valve is more or less open. The pyloric valve, itself, prevents, to a large extent, the regurgitation into the antrum from the cap when the antrum is relaxed, somewhat, like the heart valves hold up the blood column during the ventricular diastole. The cap is partly filled during each contraction of the antrum, when the pyloric canal is contracted and lengthened and the valve, itself, opens. The function of the valve is then that of filtration and holding the chyme in the reservior cap.

It is likely that the primitive gastric tube is along the lesser curvature and the large part of the fundus and corpus is a pouch, as in some of the lower animals, and there is a loop of longitudinal muscle fibers along the lesser curvature, which conducts fluids from the cardia to the pylorus. The peristaltic contraction waves begin along the lesser curvature and progress to a deep contraction, the sulcus angularis, the tip of which points to the broad, shallow, rapidly moving wave—moving from 4 o'clock to 8 o'clock along the greater curvature. The wave must traverse the longer distance of the greater curvature to reach the pylorus on time. All surgeons have recognized the greatly exaggerated disproportion of contraction waves along the lesser and greater curvatures when a *V*-shaped resection is done along the lesser curvature and how the proper emptying of the stomach becomes impossible, and that a "sleeve" resection, with a larger portion from the greater curvature markedly improves this condition.

This tendency of contraction waves along the lesser curvature from cardia to pylorus is so set that in a case of a large diverticulum off the upper part of the lesser curvature, we observed the tip of a Rehfuss' tube to always pass into the diverticulum instead of the general gastric cavity. However, the intraperitoneal triangular space along the lesser curvature or "ulcer triangle" has been resected in the longitudinal direction by Strauss[5] in 21 cases; 4 cases showed some hourglass contraction; but the roentgenograms of most of them look much like the normal stomach and in all of them; the stomach empties rapidly. If limited resections of the lesser curvature are to be done, it would likely be better to lay them in the longitudinal direction.

Several writers have shown that the removal of the pyloric portion of the stomach causes a slowing of the progress of material through the bowel; the powerful contractions of the antrum squirt the fluid chyme into the duodenum.

The process of evacuation of the normal stomach is described by Cole as follows:

> The chyme in the stomach is moved along from one chamber to another by the progressive peristalsis, there being some intermingling of the chyme of the corpus with that of the antrum. The fluid chyme is squirted through the pyloric canal into the reservoir cap and separated from the rest of the chyme in the stomach. The fluid chyme is taken out of the top or distal end of the cap by a broad peristaltic wave which carries it through the duodenum and probably continues throughout the small intestine: The frequency and activity

of this broad peristaltic wave is the fundamental phenomenon which governs gastric evacuation. Gastric tone only presses the chyme against the under surface of the cap. Progressive peristalsis, modified by systole and diastole, no matter how strong, only squirts the chyme through the lumen of the valve into the cap. The pyloric canal closes with a definite sphincteric action, but it is closed for such a very short period of the gastric cycle that it does not normally prevent gastric evacuation and, if anything, it possibly accentuates it by squirting a small amount of chyme through into the cap when it contracts. The pyloric valve tends to retain the solid food in the antrum and to allow the more fluid content to be squirted through into the cap. But if all these are functioning normally and actively, unless there is a broad peristaltic wave to propel the chyme from the top of the cap and carry it through the duodenum in finger-like masses, functional gastric retention ensues. Therefore, we must reiterate that the broad peristaltic wave in the duodenum is the fundamental phenomenon which controls gastric evacuation.

It becomes immediately evident that, if the broad peristaltic wave in the duodenum takes place in its progressive fashion from cap through the duodenojejunal junction into the small intestine, this route must be ever patent and obstruction of the duodenum will not only be followed by stasis and increase in bacterial flora, but will markedly disturb the whole gastric motor mechanism. This condition is actually observed in cases of duodenal obstruction where violent antiperistaltic waves are seen in the dilated duodenum, the pyloric canal stands wide open and antiperistaltic waves traverse the stomach as vomiting takes place.

Added to these *x*-ray findings are the clinical picture of emaciation, voluminous vomiting, dehydration and the laboratory reports of blood chemical changes and if we can accept so-called acidosis and alkalosis as causes of death in duodenal and pyloric obstructions, then death from dehydration and the blood changes. Duodenojejunostomy may completely relieve this condition and restore gastric motor function.

Two of our patients have duodenojejunostomy plus gastroenterostomy; the former with satisfactory result, and the latter a failure due to too-rapid emptying of the stomach. Certainly duodenojejunostomy, alone, would have allowed better results in both cases and, at the same time, retained the motor function of stomach and duodenum as described by Cole. Likewise duodenojejunostomy alone or duodenojejunostomy with resection of the ulcer would have relieved the stasis and tension in the duodenum in another case and would likely have forestalled the recurrent ulcer and perforation and marginal ulcer in one of these cases and, finally, would have secured the result in both cases, as was so brilliantly accomplished in other cases we have to offer for illustration.

A failure to recognize an obstruction of the duodenum may prevent the success of an otherwise properly indicated and executed operation whether that operation be simple excision, pyloroplasty, gastroenterostomy or Billroth procedures I and II.

We have seen no particularly characteristic roentgenograms of ulcer of the duodenum or stomach beyond the hypermotility of both duodenum and stomach especially in cases of duodenal ulcer. We do not feel that emptying time without pyloric or duodenal obstruction is of conclusive diagnostical importance, for we have observed forceful contractions in gallbladder cases and diverticula. We have observed a filling defect in the duodenum where it did not exist and we have failed to expose the defect where it did exist on the anterior surface of both antrum and duodenum.

A case gave, at one time, typical symptoms of duodenal ulcer, at another of cholecystitis, at another colitis with gas, soft stools with mucus. This case was diagnosed by Doctors Lafferty and Phillips and Doctors Shull and Fetner, local roentgenologists, as spastic colitis; by Dr. Fred

Baetjer of Baltimore, appendicitis with duodenal spasm; by Dr. Pancoast of Philadelphia, adhesions from cholecystitis and the following are the conclusions of Dr. Louis Gregory Cole, after a most elaborate and protracted *x*-ray study:

> There is no pyloric stenosis, no functional gastric retention—in fact the stomach empties more rapidly than usual. There is apparently some irritation, as there is considerable tendency to spasm of the cap and, at times, the peristalsis of the stomach is exceptionally vigorous.

An unfilling gall bladder, a duodenal diverticulum (never found before), a 6-inch appendix with fecaliths, and hepatic flexure adhesions, remain unoperated on and this patient remains about as happy as he could ever be.

There is a well-defined pathological anatomy and disturbed function produced by these conditions, exhibiting them clinically and by *x*-ray studies in at least 84 per cent of cases of ulcer and cancer and in 87 per cent of all cases combined and finally marked lasting benefit to the patient from proper choice of surgical procedures in about 90 per cent of cases. There remains just as definitely about 13 per cent of confused diagnoses and 10 per cent of patients who are not altogether comfortable due either to the failure of the operation, or to improper choice of the appropriate surgical procedure (Brenizer[6]).

In the stomach of the thin neurotic patient, who frequently shows a flabby bag with shallow contraction waves, where there is seen, on the other hand, a hypertonicity during the early stages of digestion, an ulcer might be suspected even when not found in the examination. Such a stomach may show a reverse peristalsis, beginning in the duodenum with periodic attacks of voluminous vomiting and point the way to a diagnosis of duodenal obstruction.

Upper duodenal obstruction or pyloric obstruction are usually well defined.

The stiffened area of carcinomatous ulceration and invasion of the stomach wall may interrupt the contraction waves and they may take up their course beyond the interrupted area.

After closure of a perforated duodenal ulcer, a form of duodenoplasty in our hands, for we cauterize the area of the base of the ulcer or infold it widely in the transverse direction, the outline of the pyloric cap is done away with, and, except for obstruction, we can make out little or nothing of details of the first portion of the duodenum. With a large pyloroplasty opening, the stomach for the first few weeks does not empty itself completely, likely due to irritability of the suture line (but there is no pain, if pain is due to a sensitization of nerve-endings made painful either by acid or contractions). The emptying time eventually becomes more rapid.

A digression for the moment to inquire as to what should be done eventually with closed perforations. Two of the patients cited who had gastroenterostomy at the time of perforation and one later would indicate future gastroenterostomy.

Following the Billroth No. 1 procedure, though the contraction waves of the stomach are shallow, the duodenum seems to pick up the waves of chyme and rush them rapidly down the intestinal tube. These duodenal contractions slow down eventually and the emptying time becomes about normal.

As mentioned, v-shaped resections along the lesser curvature exaggerate the disproportion between the contraction waves along the lesser and greater curvature and so disturb the motility as to throw the stomach entirely out of rhythm. V-shaped resections along the greater curvature speed up the emptying time of the stomach, but produce a temporary delay at the side resected, where there is some hourglass contraction.

Also, as mentioned, Strauss has reported good results following longitudinal resections along the lesser curvature, showing a roentgenogram which, in contour and emptying time, closely approaches the

normal stomach. Following "sleeve" resections, there is usually a well-marked hourglass contraction, a diminution in size and contractility of the lower chamber and delay in emptying time. It is still controversial as to whether the contraction waves in the fundus cross the suture line or not. Case[7] claims to have seen them traversing both curvatures, all the way to the pylorus.

Our results following partial gastrectomies have been overwhelmingly satisfactory. The removal of the pyloric portion of the stomach, with its powerful contractions behind the barium column has reduced the emptying time somewhat, particularly for a short time after the operations, but eventually the corpus and fundus accommodate themselves to a regular-sized meal, which these patients have taken with absolute comfort.

We have never seen a marginal or jejunal ulcer in these cases of partial gastrectomy, as we have seen following gastroenterostomy. This fact is not due to removal of the acid-secreting area, because absolutely no acid is secreted in the antrum, but by the glands in the fundus.

While gastroenterostomy, alone, has offered satisfactory results in the large majority of our cases, there have been about 20 per cent which have not been all we have desired. Some of our trouble has been due, immediately following the operation, to vomiting and we feel certain that duodenal obstruction, to a greater or lesser degree, has been the cause of the vomiting. We believe that, frequently, duodenal obstruction, "acute dilatation of the stomach" and "vicious circle" are the same thing, that is, duodenal obstruction, and that duodenojejunostomy should be substituted for gastroenterostomy. Most of the complaints have been due to a too-rapidly emptying stomach and there has been complaint of gas, soft stools and some nausea and vomiting. One patient, in particular, who had gastric retention and markedly dilated duodenum, received an anastomosis at the duodenojejunal junction, after the ligament of Treitz was severed and her stomach and duodenum empty as fast as the barium can be given. The intestine can be seen to rapidly take the overload followed by reverse peristalsis and vomiting.

In conformity with the anatomy and physiology of the clinical stomach, it would seem better to place the jejunal loop as near the pylorus as possible and bend it so that the contraction waves of the stomach and jejunum would travel in the same direction. As a matter of accomplishment, however, the use of a long enough jejunal loop to reach the pylorus may bend or twist the gut at its fixed point at the ligament of Treitz and cause duodenal obstruction. As W. J. Mayo has pointed out, the best place for anastomosis is at the most dependent point of the stomach, in the corpus between pylorus and fundus, on a line prolonging the upper part of the lesser curvature. With opening comfortably placed, we have seen little difference whether the loop is placed "isoperistaltically" or "contraperistaltically." We can readily understand how the bent and twisted jejunal loop might angulate more with varying positions of the stomach, and the proximal portion must be long to allow for the drag downward especially in the gastroenteroptotic type.

Following gastroenterostomy, most authors agree that the free and total acids are reduced from a quarter to a half in about four-fifths of the cases and relief of pain and distress is immediate in about as many cases. Likewise the relief comes quickly in the beginning of medical treatment where frequent protein feedings and alkalies are used. But most surgeons have suffered disappointment in the failure of corporic ulcers to heal after gastroenterostomy. Cole,[8] comparing corporic ulcers after gastro-enterostomy with similar cases treated medically, poses the question: "Did the ulcer heal because of gastroenterostomy, or in spite of it?"

The location of the ulcer is all important, whether in the corpus along the

lesser curvature; or in the walls nearer the greater than the lesser curvature; most ulcers in the latter location have been ulcerating areas in malignant lesions, while in the former location they are usually simple, benign ulcers, but ulcers which invade the complicated and important intraperitoneal space along the lesser curvature. Prepyloric or pyloric ulcers and postpyloric or duodenal ulcers must be considered as totally different entities and so treated. The ulcer must be located near the pyloric canal to be benefited by a gastroenterostomy.

As first pointed out by Truesdale,[9] the musculature of the pyloric canal becomes atrophic and relaxed after gastroenterostomy, and as elaborated by Alvarez:[1] the loss of function is due probably, first, to the fact that since most of the food leaves through the new opening, little is left to bear down on the pyloric canal or to be held back by it; and, second, to the fact that food is poured into the bowel about 35 cm. below the pyloric canal; the presence of food in the jejunum tends to hold back the progress of the material coming down from above, reverses the contraction waves in the duodenum and increases the amount of alkaline regurgitation into the stomach. Duodenoplasty, which does not cut across the circular muscle of the pyloric canal, does not give the relief of the pyloroplasty which does sever the muscle. The advantages of the pyloroplasty are the severed sphincter and the wide open pyloric canal for alkaline regurgitation into the stomach, not to mention the excision of the ulcer in the line of incision; the advantages of a gastroenterostomy are an atrophic and relaxed sphincter, a point of irritation and contraction in the jejunum near the new opening, with reverse movements and alkaline regurgitation through the new opening and the pyloric canal. We think it questionable as to whether the pyloric canal ought to be closed, if it can be, in gastroenterostomy.

About half a century has elapsed since the foundation of gastric operations and yet hardly a single revolutionary method, except duodenojejunostomy and Strauss' longitudinal resection of the lesser curvature has been developed during that time. Technical modifications and improvements have been added, but the principles of enlarging the pyloric orifice as laid down by Heineke-Mikulicz, the gastrojejunal anastomosis of Woelfer and the gastric resections of Billroth remain the basal procedures. The recent discussions have revolved, at times dizzily and bewilderingly, around the questions of results, what ulcerations are benign and malignant, whether the benign ever become the malignant or not. Frankly, I am still confused.

The question of location of ulcers and indications for operation run through my mind about like this:

1. Ulcers of the corpus, antrum and pylorus along the lesser curvature and duodenum are benign and frequently heal under medical treatment. Those ulcers right at the pyloric canal are mostly benefited by gastroenterostomy or pyloroplasty. Dangers are perforation, hemorrhage and obstruction.

2. Ulcers on the gastric side of the pyloric canal and outside the triangular area along the lesser curvature may or may not be malignant. The possibility of malignancy requires excision or gastrectomy.

3. Excision for malignancy should be wide and extensive and should, therefore, be extended into gastrectomy.

4. The function of the stomach following gastrectomy is frequently far superior to that following gastroenterostomy, both in emptying time and in reduction of acidity and superior in every way to that following "v-shaped" and "sleeve" resections.

It is likely that none of these operations has primarily and finally more than a mechanical effect, beyond the removal of the growth, and that no enduring physiological basis has been established beyond the drainage of the higher into the lower portion of the gastrointestinal tract. Reports are being made of patients with subtotal gastric resections and low

acidities, who are returning with new gastric and gastrojejunal ulcers.

This principle of relieving stasis satisfies most of the surgical requirements and yields, where clearly indicated, satisfactory results in the large majority of cases. After all is said, the surgeon's problem is centered on evacuation of the stomach and duodenum, regardless of the procedure employed for the removal of the lesion.

In selected cases of duodenal ulcer and even gastric ulcer, in the gastroenteroptotic type of individual and with duodenal stasis, relief of tension and stasis can be attained directly and at the same time normal motor function of the stomach and duodenum preserved by making the anastomosis, rather than between the stomach and jejunum, preferably between the duodenum and jejunum.

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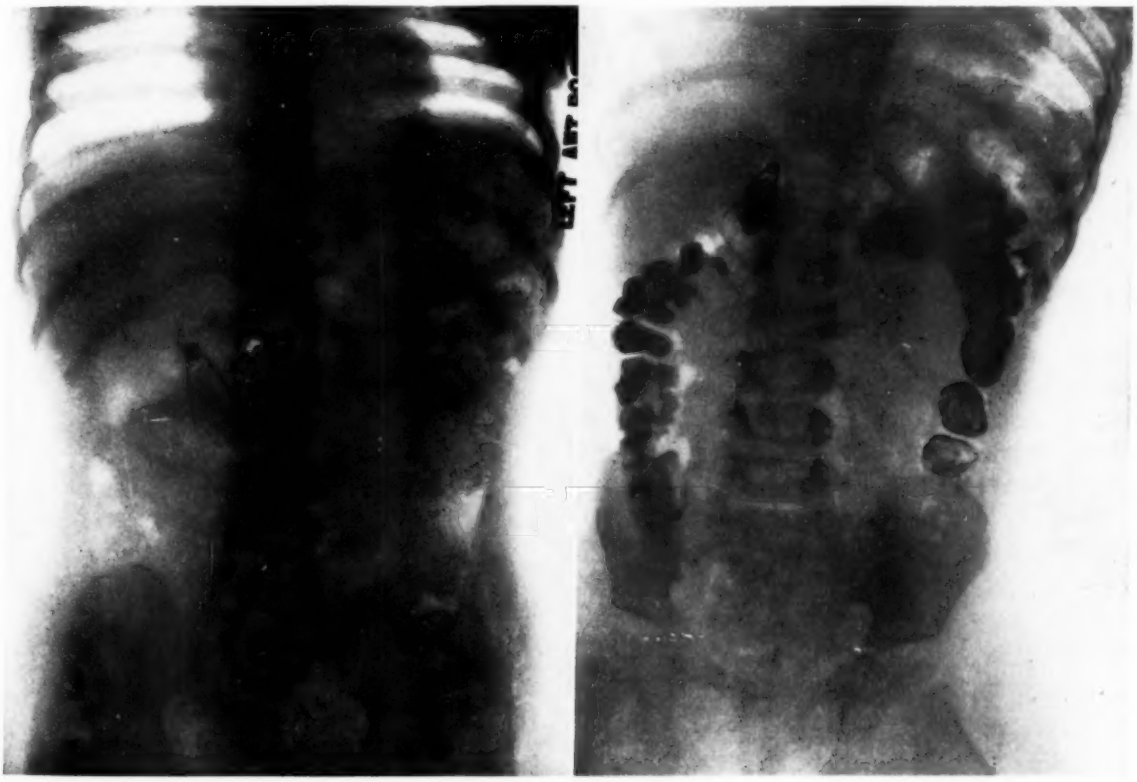
*Continued from p. 441.

REMOVAL OF AN OPEN SAFETY PIN FROM THE DUODENUM

J. THORNTON WALLACE, M.D.

NEW YORK CITY

THE occasion for this brief case report is the desire to point out that though of relatively rare occurrence, ingested foreign bodies do at times become lodged in the duodenal segment of the gastrointestinal tract. Though the foreign body in this instance was pointed and sharp, the fact remains that by far the largest number of such objects that successfully traverse the stomach and pylorus will likewise traverse the duodenum. E. L. Kellogg[1] has collected from the literature dating from 1780 to the present time, 39 instances in which the duodenum was the site of arrest of intestinal foreign bodies. These have included a variety of objects; sticks, pins and needles of different types, pencils, nails, splinters of bone, knives, spoons, button hooks, prune and olive pits, and false teeth. The majority of such, even pointed objects, pass through the digestive tract and are expelled without producing trouble. The intestinal wall, by some inherent intrinsic property, forms slight corrugations at the point of contact when touched by a foreign body, thus pushing the point away and ultimately turning it entirely around in many instances. That this action is purely reflex is evidenced by the fact that these movements take place after the connections with the vagus and solar plexus have been severed (Muller and Exner). In the less fortunate cases the object may become fixed at some point in the digestive tract (usually the lower ileum, the cecum or the



FIGS. 1 and 2.

[1] Kellogg, E. L. The Duodenum. N. Y., Hoeber, 1933.

rectum) where they may lead to localized inflammation, obstruction, perforation and localized or general peritonitis. The anatomic structure and physiologic function of the duodenum is such as to make arrest of a foreign body at this point in its descent along the alimentary canal, after its passage through the actively peristaltic stomach and narrow pyloric orifice, seem highly improbable. That such is occasionally true is well illustrated by the following case:

P. C., a fourteen-month-old baby girl, was seen to swallow an open safety pin of medium size. Its presence in the gastrointestinal tract below the diaphragm in the left upper quadrant of the abdomen was confirmed a few minutes later by fluoroscopic examination at the hands of a physician having offices in the same building. Subsequent fluoroscopic examinations were made at four hour intervals daily until its removal on the seventh day. At the examination four hours following its ingestion, it was seen to have traversed the gastrointestinal canal from the upper left quadrant to a point just to the right of the first and second lumbar vertebrae with the point directed downward. It remained at this point for seven days. It was presumed to have passed out of the stomach. (E. L. Kellogg states that any foreign body remaining localized at a point to the right of and parallel to the spinal column opposite the second or third lumbar vertebra or slightly lower, may be said with a considerable degree of certainty to be in the duodenum.) Clinically there was no irritability of the child, no manifestations of pain, nausea, vomiting, diarrhea or blood in the stools. She was, however, listless, lethargic and refused all except liquid foods. No cathartics or other medications were given.

When first seen on the sixth day after swallowing the pin, she presented the appearance of a quiet, well-behaved baby girl not in any evident distress. She was not dehydrated and careful physical examination was essentially negative except for the abdominal findings. These were slight tenderness and a suggestion of muscle spasm high up in the right upper quadrant. No masses were to be felt either abdominally or on rectal examination. She was immediately hospitalized and given a small barium meal while under direct vision of the fluoroscope. No trickle of barium over or around the pin was evident until well after the advancing opaque column had begun to pass through the pylorus, thus eliminating its presence in the stomach and the possibility of its recovery by gastroscopy. As the pin was engulfed by the barium column soon after it left the stomach, it was felt that it was lodged somewhere in the high upper small intestinal tract, probably the duodenum. Eighteen hours later, as fluoroscopy and stereoscopic plates showed the pin to remain in the same location and as the child's temperature had risen to 100° F. with an increase in upper abdominal tenderness and muscle spasm, it was decided to operate.

Under ether anesthesia, the abdomen was opened through a high right rectus incision. The pin was immediately encountered and found to lie in the duodenum. The duodenum was by careful manipulation delivered into the incision as well as its anatomical fixations would permit. The point of the pin was seen to have penetrated the mucous and muscular coats of the duodenum in its second portion and to lie just beneath the serous coat at a point about opposite the ampulla of Vater. The point of near perforation was already covered by fine cobweb adhesions to the omentum. As a partial perforation already existed, the duodenum was opened at this point by a longitudinal incision between ⅛ and ¼ inch long and the pin carefully maneuvered through it. To avoid constriction, the incision was sewed up transversely to the long axis of the duodenum with two rows of Lembert sutures of fine chromic catgut. A tab of omentum was sutured loosely over the line of incision in the duodenum. The abdomen was closed in layers without drainage. There was no postoperative vomiting. Nothing was allowed by mouth for twenty-four hours, fluids being administered by hypodermoclysis and rectal tap. The presence of acetone and diacetic acid in the urine at the end of this time made it advisable to begin the oral administration of food on the second day after operation. This was done by giving one ounce of skimmed, boiled milk at two hour intervals. This was gradually increased in quantity from day to day and on the fifth day thin cereal gruels were begun and on the seventh day a soft diet was allowed. The wound healed by primary union and the child was discharged from the hospital on the eighth day following operation, apparently none the worse for her experience.

The operative procedure followed in this case was not one of choice, but rather that dictated by conditions found to be present. Experience has shown that when possible, the safer procedure is to manipulate the object back into the stomach and remove it from there either by gastrotomy or by fastening it to a small stomach or Rehfuss tube previously passed into the stomach from the mouth and pulling it back up without opening the stomach. Opening of the duodenum is fraught with more hazards than opening the stomach or other portions of the small intestine for several reasons. The duodenum is subject to greater internal pressure than the remainder of the small intestine and in some portions its blood supply is relatively inadequate. Fistula is not infrequently a complication of operations involving the opening of the duodenum. This complication has a high mortality because added to the danger of infection there is that of the digestive action of the pancreatic secretions on sutures and abdominal wall. Danger of such may often be obviated by especial care in suturing, using absorbable suture material and exercising care that no suture completely pierces the mucosa.

GALLSTONE INTESTINAL OBSTRUCTION

H. D. JUNKIN, M.D.

PARIS, ILL.

THE occurrence of obstruction of the small intestine due to the impaction of a gallstone is sufficiently rare and interesting to warrant the publication of individual case reports. The literature contains a number of reports on gallstone ileus, including articles by H. D. Oden,[1] Curry,[2] and Marshall, Heitmeyer and Swanton.[3]

FIG. 1.

CASE REPORT

Male, aged sixty-six, admitted to the Paris Hospital, June 7, 1931.

Past History: The patient had typhoid at twenty-four and was very ill at this time. He had had no other illnesses. About five years ago had an attack of very acute pain in the epigastrium, without vomiting, requiring at this time a stay in bed for two days. The attack was diagnosed as "indigestion." In February, 1929, he had a similar attack, following which the sclerae became deeply jaundiced. Three months ago he had an attack of "indigestion" with diarrhea, with severe epigastric pain.

Present Complaint: At noon June 6, 1931, the patient had severe colicky pains which extended transversely over the abdomen at the level of the umbilicus. Two normal stools were passed during the morning. No vomiting occurred. Pains were paroxysmal in character, and very severe. Some peristaltic waves could be seen over the abdomen. After noon of this day he could pass nothing by bowel. Various cathartics taken were vomited. Enemas gave no relief. He was admitted to the hospital, June 7, 1931.

Physical Examination: On admission, the patient was in great distress, with marked distention of the abdomen. He would cry out with pain. His body was covered with beads of perspiration. Foul-smelling eructations of gas with fecal vomiting occurred at frequent intervals.

The patient was 5 feet, 11 inches in height and weighed 270 lbs. Pupillary reactions were normal. The tongue was heavily coated, teeth in good condition. The thyroid was negative, well-formed chest; breasts negative; lungs clear, there being no râles; no consolidations; no friction rubs. The heart was very irregular; apex in the fifth interspace, extending to within 1 cm. of the left anterior axillary line. The skin was quite cyanosed. No gas was expelled after repeated colonic flushing.

The next day, June 8, the patient continued in a very serious condition. Vomiting persisted.

On June 9 a fluoroscopic examination was made, as follows:

The heart extends 5 cm. to the left of the left mid-clavicular line, resting on the diaphragm, which is pushed up high into the chest cavity on account of the increased intra-abdominal pressure. Aortic shadow greatly broadened.

The barium enema filled the entire colon without defect. Barium by mouth showed normal esophagus, stomach, and duodenal bulb. In all positions, many coils of small intestine are noted greatly distended with

[1] ODEN, H. D. Duodenal stenosis due to gallstone. *Deutsch. Ztschr. f. Chir.*, 231: 427–435, 1931.

[2] CURRY. Gallstone intestinal obstruction. *J. Michigan State M. Soc.*, 30: 24–25, 1931.

[3] MARSHALL, HEITMEYER, and SWANTON. Intestinal obstruction due to gallstones. *Wisconsin M. J.*, 30: 18–19, 1931.

gas, warranting the opinion that the obstruction existed in the small intestine. The patient vomited large amounts of dark brown fluid with globules of oil floating on the surface. Three hours later a second observation was made. The head of the meal had stopped at a point thought to be near the jejuno-ileal junction.

The patient was so ill that further examination was dispensed with. Next morning we placed a duodenal tube in the stomach and left it in situ, with much relief. Quantities of fecal material drained from this tube. The usual hypertonic solutions of salt were continued both intravenously and by hypodermoclysis.

On June 11 the patient felt much improved. A little gas had been expelled per rectum. A pint of hypertonic salt solution was then given through the duodenal tube and the tube clamped for an hour. The solution was not returned. About 7:30 P.M., the same day, the patient had a desire to defecate but felt something obstructing the rectum. Digital examination disclosed a stone-like mass (Fig. 1), cylindrical in form, about 6 cm. in length and about 3 cm. in width, which was removed with difficulty by use of placental forceps. Considerable bleeding followed this procedure. The patient made a very prompt recovery. Consulting physicians confirmed our opinion that laparotomy was a most hazardous undertaking, owing to the obesity of the patient and the circulatory disturbance. Hence, the procastination.

Dr. B. G. R. Williams, pathologist, reported:

"The material is acellular and I will not attempt an examination. It seems to be entirely free from calcium carbonate and calcium oxalate, and this explains why the *x*-ray examination failed to show the shadow. The outermost shell is composed almost entirely of cholesterin crystals. The bulk of the specimen is made up of amorphous organic matter, bile salts, pigments, blood derivatives, etc. Therefore, the idea is seducing that the mass was formed in the gall bladder, an opinion which, however, cannot be proven, inasmuch as it may have been formed in the upper gut where these substances abound. I would hardly think that it could have been formed in the colon."

ACUTE INTESTINAL OBSTRUCTION DUE TO GALLSTONES*

I. JACK VIDGOFF, M.D.

LOS ANGELES, CALIF.

ACUTE intestinal obstruction due to gallstones is a relatively rare condition. Out of 3064 cases of intestinal obstruction reported from seven hospitals in England in 1925, there were 28 cases due to gallstones.[1] This is equal to less than one case per year per hospital.

Bartholin[2] reported the first case in 1654. Courvoisier[3] in 1890, reported 131 cases, 70 of which were spontaneously cured by the passage of the stone per rectum. Martin,[2] in 1912, sent out a questionnaire to several physicians. Out of an estimate of one-half million operations, there were 16 cases of intestinal obstruction due to gallstones. This makes an average of one case to approximately 30,000 operations. Von Wagner[4] found 334 cases up to 1914. Robson[2] out of 80,000 hospital patients in four large British hospitals found 4 cases.

INCIDENCE

The condition is more common in women between the ages of fifty to seventy years.

PATHOLOGY

The entrance of the gallstone may be through the bile ducts, but more commonly is through a fistula between the gall bladder and the small bowel. The most common point of entrance is through a fistula between the gall bladder and duodenum.

According to Schläpfer[5] the pathology begins with a cholecystitis resulting from the gallstones. There then follows an ulceration and pericystitis with adhesions between the gall bladder and the duodenum. Perforation then occurs within the adhesions.

SYMPTOMS

It is interesting to note how seldom patients have earlier symptoms pointing directly to the gall bladder. In this series of 4 cases at the Los Angeles County General Hospital, within the past two years, not a single case gave a history of previous gall-bladder attacks.

The symptoms are those of intestinal obstruction, only they are more gradual in onset. The patient experiences abdominal cramps which are followed by vomiting. The bowels may be active and flatus may be expelled. Vomiting continues for about three to five days, and intestinal obstruction is eventually suspected when the patient begins to vomit fecal matter. The reason for the milder symptoms is that there is no early strangulation of the bowel. The gallstone occludes the passage of the bowel and gas may escape around the stone which prevents early distention with obstruction to the blood supply.

On examination, the patients are usually found to be dehydrated. There is only slight distention as a rule. Usually an abdominal scar is absent, or if present is incidental. There may be tenderness in the lower abdomen. There is usually an absence of fever.

The *x*-ray, scout film, may show the stone early before there is distention of the small bowel. After the loops of bowel are filled with gas it is difficult to isolate the shadow caused by the stone, but a diagnosis of small bowel ileus can readily be made.

Most patients do not have icterus because there is no obstruction of the common duct.

The site of obstruction is usually in the terminal ileum where the bowel is narrowed.

* From the Surgical Services of the Los Angeles County General Hospital. Read before the Surgical Section of The Los Angeles County Medical Association, January 8, 1932.

Courvoisier described 4 in the duodenum, 4 in the jejunum, 40 in the ileum, and 2 each in the appendix and colon. In this series 3 were in the terminal ileum and one in the jejunum.

While the mortality reported is high, the prognosis is good with early operation before strangulation takes place. Most cases do not come to operation before five to eight days after the onset of obstructive symptoms which accounts for the high mortality. Herman reports a mortality of 63 per cent, Schiller 56 per cent, Moller 82 per cent, Martin 69 per cent, and Wagner 48 per cent. The mortality in this series was 50 per cent.

The treatment of choice is enterotomy. The stone is moved past the point of obstruction and the bowel is incised along its longitudinal axis, over the stone. The stone is removed and the bowel sutured transversely in two layers of gastrointestinal sutures. It is best to apply a rubber-covered clamp on the bowel to avoid any spill of intestinal contents. The abdomen is closed without drainage.

CASE REPORTS

The following 4 cases were operated upon at the Los Angeles County General Hospital during the period of July, 1929 to July, 1931.

Case I. Mrs. M., aged sixty-four, was admitted to the hospital September 11, 1929. Her chief complaints were pain in the abdomen, nausea and vomiting, and constipation. She first experienced this pain three weeks prior to her admission. The pain persisted and extended throughout the entire abdomen. Vomiting was persistent especially after eating. There had been no jaundice. Constipation was always present, and cathartics were necessary for bowel action.

On examination she presented some distention, and tenderness in the lower abdominal quadrants. The heart and lungs were negative.

The urine was negative except for some acetone. The blood chlorides was 445 mg. per 100 c.c. of blood and the carbon-dioxide content of the blood was 58 per cent. The non-protein nitrogen was 37.5 mg. The leucocyte count was 9750 with 75 per cent polymorphonuclears.

She was treated with saline by hyperdermoclysis and glucose intravenously and nothing was given by mouth.

The next day she complained of generalized abdominal cramps and continued to vomit. The third day she began vomiting fecal matter. The abdomen became more distended. There was rebound tenderness in the lower abdomen. There was an elevation of temperature and the leucocyte count rose to 14,500 with 85 per cent polymorphonuclears. A flat plate of the abdomen was taken which showed distended loops of small bowel consistent with a small bowel ileus.

She was operated upon three days after admission. A large gallstone was found in the jejunum. Another loop of bowel was attached at this point and a perforation of the bowel with a generalized peritonitis was present. The stone was removed, the bowel was sutured and the abdomen drained. The vomiting continued, the pulse became weak, and the patient died the next day.

The attack of pain this patient experienced three weeks prior to her entrance was not a gall-bladder attack. These stones may remain in the intestinal tract for years before symptoms are produced. The attack in this case was probably an early intestinal obstruction which was partial at the time. Not until the obstruction became complete did the patient come to the hospital. The tenderness and leucocytosis later was the result of the perforation and peritonitis which greatly influenced the final outcome.

Case II. Mrs. R., aged sixty-seven, was admitted to the hospital April 25, 1930. Her chief complaint was vomiting which had continued for the past five days. The onset began with epigastric pain which was followed by vomiting. Her previous health was always good except that she was always constipated. There was a weight loss of 6 pounds during the past six months. There was no history resembling a gall-bladder attack. There was no jaundice, and the patient had never had typhoid fever.

Examination showed a dehydrated old woman with a fecal odor to the breath. The abdomen was not greatly distended and there were no masses or scars. There was no evidence of rectal carcinoma. The urine showed a four

plus acetone, and the leucocyte count was 14,050 with 85 per cent polymorphonuclears. The blood chlorides were 330 mg., and the non-protein nitrogen was 80.

X-ray of the abdomen showed a distended small bowel typically that of a high grade ileus. No calculi were demonstrated.

A diagnosis of intestinal obstruction was made and the patient was operated upon soon after her admission.

Operation: Under spinal anesthesia, a right rectus incision was made. The small bowel was found to be distended. A hand was placed in the abdomen and a firm mass was felt and brought up into the wound. The bowel was distended above and contracted below this mass, which was situated in the terminal ileum. A clamp was applied to the bowel and an incision was made along its longitudinal axis. A gallstone measuring 4.5 by 3 cm. was removed. The bowel was then sutured transversely with two layers of gastrointestinal sutures and the abdomen was closed in layers. Recovery was uneventful and the patient left the hospital ten days later.

Case III. Mr. H. W. entered the hospital December 11, 1930. This patient first noticed heart trouble one year ago when he consulted a doctor for edema of the ankles and dyspnea. He was under a doctor's care and did light work up to a few days prior to examination when he had a recurrence of his former symptoms and was forced to rest again. No history of any abdominal complaints.

Examination showed a heart that was enlarged to the midaxillary line. The pulse was fibrillating with 136 beats at the apex and 80 at the pulse. There was a systolic murmur at the apex. The blood pressure was 136/100. There was moist rales and impaired resonance over the bases of both lungs. The abdomen was distended and tympanitic with shifting dulness in the flanks. There were no scars and no evidence of rectal cancer. The blood chemistry was entirely negative. *X*-ray showed a high grade ileus, but no calculi were shown. The patient vomited fecal matter and was subjected to surgery.

Operation: There was a complete obstruction at the terminal ileum, about 2 inches from the ileocecal junction, due to a large gallstone about the size of a small hen's egg. General peritonitis was present and well advanced. A large quantity of fluid was present in the abdominal cavity.

The intestine was opened through a longitudinal incision and the stone removed. The opening was closed transversly with two layers of gastrointestinal sutures. The intestine above was drained by placing a glass tube into the lumen of the bowel and stripping it with the fingers. About a gallon of liquid feces was removed. The patient left the table in poor condition and died soon afterwards.

Autopsy. There was a pitting edema of the lower extremities. The pleural cavities contained about 200 c.c. of yellow transudate. The lower lobes of both lungs showed marked edema. The heart weighed 500 gm. There was considerable hypertrophy of the left ventricle with moderate dilatation of the right auricle and ventricle. There were considerable adhesions in the right upper quadrant between the liver, gall bladder, duodenum, and great omentum. In the first portion of the duodenum there was a fistula admitting the ring finger. This fistula connected the duodenum with the gall bladder. About the gall bladder and duodenum were many thick adhesions. The gall bladder was thickened and contracted and contained a few small stones. There were many gallstones in the hepatic ducts.

Case IV. Mrs. J. H., aged sixty-seven, entered the hospital January 6, 1931, complaining of pain in the epigastrium, tenderness throughout the abdomen, and foul-smelling vomitus. The onset was three days prior to her admission with severe cramps in the abdomen, vomiting, and inability to move the bowels. The patient noticed that the vomitus resembled fecal matter. There had been no attacks of upper abdominal pain, and the patient had never had typhoid fever.

Examination showed a dehydrated old woman, not very toxic in spite of the fecal vomiting. The abdomen was slightly distended. There were no scars on the abdomen, and the rectal examination showed no masses nor tenderness. The pelvic examination was negative. The blood count was 13,000 with 85 per cent polymorphonuclears. The urine was negative.

Because of the two previous cases within the past six months a flat plate was taken to determine if the obstruction was due to gallstones. A diagnosis of intestinal obstruction due to gallstones was made on the basis of the age and sex of the patient in the absence of an abdominal scar and the absence of any evidence of

cancer of the bowel, with the symptoms of intestinal obstruction over a period of three days and very little toxicity. The *x*-ray showed an extreme dilatation of the small bowel typical of a high grade ileus. No calculi were demonstrated.

Operation: A right rectus incision was made. A gallstone was found about 3 inches from the ileocecal junction. The stone was removed and the bowel sutured. Before the abdomen was closed the upper quadrant was explored and there was found a mass of adhesions between the gall bladder, bowel, and great omentum. These were not disturbed and the abdomen was closed in layers.

Postoperatively the patient was given glucose intravenously and sodium chloride by hypodermoclysis, and frequent gastric lavages through a Levine tube. The patient recovered from the operation and six months later in a follow up letter stated that she has had no pain and that her bowels were moving regularly.

SUMMARY

1. While intestinal obstruction due to gallstones is a relatively rare condition, yet one should suspect it in women past the middle age with symptoms of intestinal obstruction in the absence of an abdominal scar and carcinoma of the large bowel.

2. Early diagnosis will reduce the mortality because there is no early strangulation of the bowel.

3. Four cases are reported, three of which were in old women. In no case was there a history of previous gall-bladder disease. One stone was found in the jejunum and three in the terminal ileum. Not a single case came to operation before the patient vomited fecal matter. The mortality was 50 per cent. One death was hastened by peritonitis due to a perforated bowel, and the other by cardiac decompensation.

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A REVIEW OF THE RECENT ADVANCES IN THE KNOWLEDGE OF THE PATHOLOGY OF THE LIVER AND THEIR CLINICAL APPLICATION

FERDINAND C. HELWIG, M.D.

KANSAS CITY, MO.

DURING the past ten years, gigantic strides have been made in advancing our knowledge of the anatomy, physiology and pathology of the liver. There has been no subject during this period which has received more attention nor about which more has been written. It is, therefore, manifestly impossible to give more than a sketchy outline of the more important contributions which seem to have some bearing on actual clinical problems.

The morphologic variations produced in the liver by disease are well known, but in many instances their pathogensis is little understood. However, recent studies of the structure and function, as applied to actual perverted anatomy, are daily bearing fruit; and many diseases, whose explanation was previously enigmatic, are gradually being clarified.

ANATOMICAL ADVANCES

Structurally speaking, the liver is a relatively simple organ although it has many unusual features. Aside from the entire mass of skeletal muscle, the liver comprises the largest single homogeneous tissue in the body. Another characteristic possessed by no other organ in the body is the unique double blood supply of the liver; namely, the portal blood supply from the intestines, stomach and spleen, and the arterial blood supply from the hepatic arteries. The portal blood flow is controlled largely by nerves outside the liver; hence, the latter has no direct influence over the quantity of blood entering it, which fact may be of considerable clinical importance in certain pathological alterations in the liver.[1]

The cellular anatomy of the liver is simple in the extreme. Only three types of cells are present: the parenchymatous or liver cells, the cells of the bile ducts, and the stellate cells of Kupffer which line the liver sinusoids. All of these cells are arranged into lobules of which two distinct varieties are recognized; namely, the "central vein" lobule and the "portal space" lobule. In the former, the central vein forms the center of the lobule, and the portal spaces, which are composed of connective tissue in which are embedded the portal vein, hepatic artery and bile duct, form the periphery of the lobule. In the latter type of lobule, the "portal space" forms the center of the lobule and the central veins form the periphery.

Some of the recent advances which have an important bearing upon diseases of the liver have been made through investigations of the anatomy of healthy and diseased livers. McIndoe and Counsellor[2] injected the biliary tree, portal system and hepatic arteries with celloidin, digested out the parenchymatous tissue and thus obtained cases of the blood and bile systems. Their work has demonstrated that the liver has a bilateral nature which may be of significance in explaining the pathogenesis of certain lesions confined to one or the other half of the liver. These investigators, by their models thus prepared, showed that the right and left branches of the portal vein remain separate and do not anastomose at all. This fact holds true, likewise, for the right and left bile ducts and the hepatic arteries. The previous conception of the gross anatomy of the liver lobes had to be revised. The old division of right and left lobes divided by

the falciform ligament does not hold true, but now we feel that the line which divides the right and left halves of the liver is one drawn from the fossa of the gall bladder to the point of entrance of the hepatic vein into the inferior vena cava. McIndoe and Counsellor,[2] by their injection experiments, likewise demonstrated the extent of restriction of the portal circulation in cirrhosis of the liver, which studies are of great importance from the standpoint of their bearing on collateral circulation.

Their preparations proved that the hepatic cells were almost completely removed from the portal blood. In the normal liver preparations, it was seen that the space relations between the portal spaces and the central vein were just one-half the diameter of the lobule, but in the livers in which atrophic cirrhosis was present, it was found that the relation of the lobule was completely distorted and the two vascular systems tended to lie together, "assuming a basket-like arrangement." The regenerated nodules of liver parenchyma were found to contain no venous supply, which fact may have some bearing upon the question of ascites without liver insufficiency. In the livers of cases of obstructive jaundice which were injected, an almost unbelievable dilatation of the biliary tree was seen. This enormous dilatation must unquestionably have some bearing on certain functional changes encountered in obstructive jaundice. Moreover, a marked intertwining of the portal and biliary systems was likewise seen, which fact may help to clarify the pathogenesis of certain mixed types of cirrhosis.[2]

Another interesting and remarkable piece of research work which seems to have clinical application was done by Copher and Dick,[3] who observed what they called "stream lines" in the flowing blood of the portal vein. They showed that there were three such stream lines, which lines corresponded to the organs from which the blood flows. First, the portal blood, collected from the stomach and spleen, is found to pass to the left lobe of the liver; while the second stream, or that blood collected from the upper part of the duodenum, head of the pancreas and jejunum, passed to the right lobe; and the third stream, whose blood arose from the colon, was distributed to all parts of the liver, more particularly to the left lobe. Moreover, they found that there was little or no intermingling of these three streams. Copher and Dick made their experiments by injecting trypan blue into the different distal ramifications of the portal vein and by means of strong transillumination they were able to observe where this dye was carried. When the liver was later removed, it was found that that part of the liver to which the blood flowed was deeply stained by the dye.

PHYSIOLOGICAL AND CHEMICAL PATHOLOGY

Function: For many years, this great organ, the liver, was thought of as one which excreted bile, stored glycogen, and acted as a sort of a filter for all kinds of poisons brought in by the portal blood. Many other hazy functions or pseudo-functions were also ascribed to it, but accurate knowledge was extremely limited. To Mann,[4] of the Mayo Clinic, we owe a great debt, not only because he is one of the foremost investigators of liver physiology but because he has aroused an unusual general interest in this organ.

Total Removal of Liver: Mann saw that one way to get an insight into the function of the liver was to remove it completely and see what happened. This, of course, had been tried many times previously, but had always presented tremenduous technical difficulties. Previously, all the work had been carried out with so-called "acute experiments"; that is, animals under anesthesia which did not recover. Moreover, previous investigators had been forced to remove so much other functioning anatomy that no data of great value had been obtained prior to Mann's work. By an extremely ingenious though simple method, Mann overcame these previous difficulties

in complete liver extirpation by simply performing a so-called reverse Eck fistula. He then waited for collateral circulation to be established, and then completely removed the liver. He found that the animals (dogs) recovered quickly from the operation, and he was thus able to observe their actions as had never before been done. In about an hour, these animals appeared almost normal. They would even eat, take an interest in their surroundings, and appeared in every way similar to other dogs. This condition, however, did not last very long for symptoms of liver deficiency soon appeared. We can do no better than to quote Dr. Mann who makes the following interesting clinical observation of these liverless animals:

> The first symptom noted is muscular weakness; the animal can not hold itself erect or avoid swaying when walking, and prefers to lie down. The muscular weakness develops quickly and in a short time the animal is unable to move any of his muscles except those necessary for respiration. Coincident with this development of muscular weakness is a decrease in and subsequent loss of reflexes. Usually within an hour after evidence of muscular weakness is first noted, the animal lies quietly breathing with muscles flaccid and relaxed. This period of flaccidity may be short, but rarely it may last for several hours. After a variable period, usually not more than an hour, there is a rather sudden return and exaggeration of the reflexes, muscular twitchings appear, first involving separate muscles or small groups of muscles, then general convulsions occur in one of which the animal dies. In typical experiments, the animal vomits a few seconds before death. The average animal dies within two hours after the first appearance of muscular weakness.

Mann also observed that certain changes invariably occurred in the urine and blood of dehepatized animals. In the blood, there was a progressive decrease in sugar, the appearance and progressive increase of a pigment, the progressive increase in uric acid, and the characteristic changes noted in the urine were the appearance of a heavy flocculence and of a yellow pigment.

Sugar Metabolism in Total Hepatectomy: Mann then investigated the cause of the symptoms noted above and made many thrilling observations. As regards the hypoglycemia, it was found that there was always a decrease in blood sugar after total removal of the liver and, after convulsions set in, the blood sugar fell very rapidly and one of the most constant and remarkable facts was the direct relationship between the blood sugar level and the clinical symptoms. Mann then supplied sugar to these dying animals in the form of intravenous glucose, and he was able, by so doing, to completely restore the dying animal to a normal condition. These animals, which just before receiving sugar were comatose and "unable to contract any muscles but those of respiration," would, within a half minute after the sugar injections, stand up and even walk about, wag their tails and drink water. If the animals were permitted to have convulsions, which in the untreated animals were always followed by death, the results of intravenous sugar injections were even more spectacular. The convulsions would cease as if by magic and the animals would rise and walk about normally. It was even possible to let the heart stop beating, and give the animal artificial respiration and then an injection of sugar. Mann literally recalled such an animal from death. After using up the injected sugar, the dogs would again lapse into the same state of hypoglycemia from which they could be restored numerous times, although the same amount of sugar did not suffice with the ensuing attacks, and soon the characteristic symptoms of sugar deficiency began to appear at higher blood sugar levels. At last, after numerous revivals, the animals would reach the stage where sugar injections were of no avail. They became restless, vomited, breathed with difficulty, could neither see nor hear and, finally, lapsed into unconsciousness and died a slow quiet death which was usually preceded by anuria. Sugar did not alter the course of this set of symptoms but it

was necessary to keep up the injections in order to prevent death from hypoglycemia. Sugar could be given by mouth or rectum, at intervals or continuously, with the same results as those obtained by repeated or continuous intravenous administration.

When the pancreas was removed in a dog, the animal developed a high blood sugar and died in several days with hyperglycemia. Now, if the pancreas was removed at the same time as the liver, there was no difference observed from those animals where the liver alone was removed. If the pancreas was removed at some prior time and hyperglycemia was present, when this excess sugar was used up the dog developed the same characteristic hypoglycemic symptoms as if the liver alone had been removed. Those experiments proved that the liver alone was responsible for the maintenance of the blood sugar level, even in the hyperglycemia of diabetes.

Mann also observed that glycogen was decreased in the development of hypoglycemia in the liverless dog, but no matter how much glycogen was present in the muscles it in no way influenced the development of symptoms of hypoglycemia since it evidently could not be utilized for maintenance of blood sugar level and never left the muscle as blood sugar but was utilized by the muscle and changed into lactic acid in situ. Hence, it was apparent that the liver glycogen alone comprised and was present as the blood sugar, and muscle glycogen was not utilizable. He showed that there could be more than sufficient glycogen in the muscle to maintain even a hyperglycemia for a long time, yet the animal would develop its characteristic hypoglycemia and typical accompanying symptoms like an animal with little stored muscle glycogen.

Mann also investigated many substances in connection with the blood sugar level, but of most importance was insulin. Since both hepatectomy and insulin injections produce a hypoglycemia, and both are accompanied by characteristically identical symptoms, Mann wondered what the effect of insulin would be in the hepatectomized dog. He found that insulin merely acted as if the liver were present; namely, it caused a rapid development of hypoglycemia, and the only difference between dogs with and without livers was that insulin caused hypoglycemia much more quickly in the latter case than in dogs with intact livers. The symptoms of hypoglycemia in the liverless dog which was given insulin were the same as if insulin had not been administered. Glucose produced the same response as if insulin had not been given. Hence, he concluded that:

> Although the liver is not necessary for the production of the hypoglycemic action of insulin, it is absolutely necessary for a permanent recovery of the blood sugar level, and this did not mean that the liver played no part in the production of the hypoglycemia of insulin. However, the fact that the liver is essential for the restoration of the normal blood sugar level proved that the liver is affected either directly or indirectly by the insulin.

Protein Metabolism in Total Hepatectomy: The question of protein metabolism was next studied. In catabolism, protein is broken up into aminoacids and these have been the subject of many experiments. Mann showed that the liver is probably the sole source of urea formation, since in the liverless dog he noted a striking and progressive decrease of urea in the urine, and in a few hours scarcely any was present in the blood, urine or tissues. If he took out the dog's kidneys at the time he removed the liver, the urea content of the blood remained the same throughout and showed no increase. If the kidneys were removed before taking out the liver, there was an increase in blood urea and after hepatectomy this high level was maintained but not accentuated in the least.

Mann also noted a marked increase in aminoacids in the blood when the liver was absent and no splitting of the amino-

acids into nitrogen with urea formation. Hence, it seems to be definitely proved that both urea formation and deamidization of aminoacids are functions of the liver.

Creatine and ammonia formation did not seem to be materially affected by liver extirpation. The protein metabolism experiments have led to a test for liver function. In Leipzig, according to Snell,[5] the following is used as a test for hepatic activity: 50 gm. of gelatine are administered to a patient and, during the next two periods of four hours each, the urine is examined for aminoacids. At least 200 mg. of aminoacid are found to be present in the urine of patients with diseased livers after the first period of four hours, and in the earlier specimens a marked decrease in output is found.

Mann showed that in the dog, uric acid destruction depends entirely on the liver. He noted an excretion of as much as 1500 mg. in twenty-four hours in some of his animals. Unfortunately, this substance has little clinical significance in the human.

Bile Studies in Total Hepatectomy: Bile is another substance which for many years has been the subject of heated controversy. Naunyn and Minkowski[6] many years ago, when experimenting with geese, removed the liver and then poisoned these birds by injecting arseniuretted hydrogen which is a powerful hemolysing agent, and were unable to observe any bile formation. From this work arose the old dictum, "Without the liver, no jaundice." However, this did not explain such jaundice as is seen in hemolytic icterus, and some other conditions where no relative liver damage or biliary obstruction can be demonstrated.

About eighteen years ago McNee,[7] working in Aschoff's laboratory in Freiburg, repeated Naunyn's and Minkowski's experiments and also destroyed dogs' livers with specific poisons. He noted that the stellate cells of Kupffer were loaded with bile pigment. After much investigation, he was led to believe that the bile pigments were manufactured in or by the endothelial reticular cells, and he overcame the arguments of Naunyn and Minkowski in regard to jaundice being caused only by the liver by showing that in the goose most of the endothelial reticular cells are in the liver. As a result of this investigation, there has been an enormous amount of work done on this subject. In such investigations, the names of Whipple and Hooper,[8] Arnold Rich,[9] and McNee are outstanding.

Many contradictory experiments followed these observations of McNee and then Mann started his experiments with reference to bile production. He injected hemoglobin intravenously into liverless animals. The spleen was removed both before and after the liver was removed and, in another set of animals, all the abdominal organs as well. He noted that in the liverless dog, bile was readily produced and increased progressively, which was also true in the dehepatized, spleenless animal. It was necessary to prove that squeezing the liver at the time of operation did not cause bile to flow into the circulation, but since none was encountered in the plasma of the liverless animal immediately after operation, the possibility of squeezing bile into the circulation evidently was not a factor.

Mann also showed by removing the gastrointestinal tract along with the liver that bile was not absorbed from the intestine when a progressive increase in the pigment in the plasma was obtained in dogs prepared in this manner. The amount of bile present in the blood was too large for any other viscera to hold or manufacture after the spleen and gastrointestinal tract had been eliminated. Hence, it was concluded that there must be some extra-abdominal origin of bile, and this location was found to be the bone marrow. Although the Kupffer cells of the liver may make some bile pigment, it is definitely proved that the bone marrow is the main important site of its formation.

Among other bile constituents beside pigment, cholesterol and bile salts were

investigated. As to the cholesterol, it was not proved to be manufactured in the liver. Although the liver excretes it in the bile, its origin is still hazy. The origin of bile salts is likewise still unsolved. There is some evidence to show, however, that the salts may be manufactured in the liver. One investigator, Forsgren,[10] noted acidophile granules in the hepatic cells near the periphery of the lobule which he thought were bile salts.

Greene and Snell[11] found a rapid and marked increase in bile acids in the blood in obstructive jaundice. This is accompanied, of course, by bilirubin retention, as well as retention of dyes. The animals recovered from all of these retentions, except in their ability to excrete dyes. The clinical importance of dye retention is, therefore, considerable. The relationship of bile acid retention to the slow pulse, itching, and slow blood clotting is important since, contrary to the older teachings, it has been shown that the increase in bile acids in the blood has no such relationship. Instances of hemorrhage and delayed coagulation have frequently been observed where the bile acid level had returned to normal.

The consideration of bile pigments in their relationship to the liver are of enormous importance to the clinician from the standpoint of diagnosis, and everyone now uses the Van den Bergh test to estimate the origin of jaundice. There is no doubt that the direct reaction depends on the hepatic activity which can be proved by mere ligation of the common duct and the appearance of a quantitative increase of bilirubin in the serum. Mann removed the livers of these dogs with ligated common ducts after a few hours, and he noted the same progressive increase in bile pigments in the blood; but, instead of giving the direct reaction, all of the bile that accumulated after hepatectomy gave the indirect reaction. This observation is of tremendous clinical importance although its physiological significance is still obscure.

Detoxifying Action of the Liver: The liver as a detoxifying agent has been carefully studied. Drinker and Shaw[12] showed that in the liver the stellate cells of Kupffer remove foreign particles from the blood stream. Flexner and Sweet[13] found that the liver excreted the toxins of dysentery, mercury and ricin in the bile and it is probably true that many of the heavy metals are strained out of the blood and eliminated in this manner. Mann noted that dogs whose livers had been removed could not stand injections of phenol, benzoic acid, phenol tetrachlorphthalein, and other substances which the normal could withstand, and the quantity which had no effect on normal dogs killed liverless dogs. Recently, Priestly, Markowitz and Mann[14] have demonstrated that the liver possesses a highly specialized ability immediately to arrest and subsequently to destroy strychnine, and at this time many experiments are being carried out with other substances.

Fibrinogen Formation: The origin of fibrinogen has always been obscure, and many investigators have attacked the subject. The question of bleeding in the jaundiced patient, slow clotting of blood in patients with a damaged liver, and similar questions are of great clinical importance. Mann has concluded, after much experimentation, that all the evidence for the liver being the site of formation of fibrinogen is not conclusive although the most important fact of clinical importance is that injury or removal of the liver does actually affect the formation of a normal blood clot. Whether lack of fibrinogen production is the most important factor in this case, however, is not definitely decided. Brandes,[15] by mechanical constriction of the hepatic veins, noted a definite decrease in blood coagulation time, ranging from 25 to 50 per cent during constriction which was followed by an increase on release. There was a slight decrease in fibrinogen during constriction and an increase of 25 per cent or more on release.

Partial Hepatectomy: All of these foregoing experimental works of Mann's were performed on animals where the entire liver had been extirpated, but the question arises as to what happens when some functioning liver tissue remains. How much liver is needed to carry on life and what happens when large quantities of the liver are removed? These are all matters of great importance. The first observation made after surgical removal of great portions of the liver was its stupendous power of regeneration. It has been shown that if 70 per cent of the functioning liver in a rat is removed, in four weeks the liver will be regenerated to normal size. Even if 85 per cent of the liver of a dog is surgically removed, the liver apparently can carry on relatively normal function. Although its detoxifying functions are seriously impaired, the maintenance of the blood sugar level, formation of urea, and deaminization are not in the least disturbed.

Fat Metabolism: The role played by the liver in fat metabolism has also been the subject of considerable study. Wendt[16] records a marked disturbance of fat resorption in cirrhosis. Bürger and Habs[17] noted and absence of lipemia in a patient with atrophic cirrhosis, who had been given large doses of olive oil and cholesterol. This administration always produced lipemia in normal individuals. They also noticed such an absence of lipemia in any person with extensive portal stasis. Elmer and Scheps,[18] however, did not find this dependable. Wendt likewise observed in patients with severe icterus that there was a diminution of cholesterol esters in the plasma.

Cassano[19] found a marked disturbance of fat metabolism in liver disease. There is an increase in fatty acids in the blood, indicating an increase in neutral fats and a decrease in phosphatids. Cassano felt that the fatty acids were partly bound with cholesterol forming cholesterol esters. Drury and McMaster,[20] on the other hand, found that fat combustion is carried on adequately in animals deprived of their livers, or those with extreme liver insufficiency. They observed no change in fat combustion as late as twenty-four hours after complete hepatectomy, and they believe that the liver played no essential part in the breaking down of fat. Derman and Leites[21] found by feeding experiments and chemical studies that the liver played an active part in lipoid metabolism. They thought that metabolites may be built up into other fats and lipoids. An actual infiltration of anistrophic fat into the liver can be accomplished by injecting chloroform and feeding cholesterol. Whether this proves anything of importance is, however, yet to be demonstrated. Of clinical importance is the function test. The cholesterol function test is the test employed by Mancke[22] who observed that there was a marked increase of cholesterol in the blood in obstructive jaundice of long duration; but in the toxic or infectious types of icterus, the cholesterol may be normal while the esters of cholesterol are found to be greatly decreased.

Hepatic Poisons and Cirrhosis: Many studies have been carried out by the use of hepatic poisons. Of these, carbontetrachloride has recently been used extensively. The dosage of the drug can be so regulated as to produce a liver cirrhosis closely simulating that found in man. Such cirrhosis is the basis of many current experiments of interest.

Obstruction to the outflow of bile is a time-honored experimental procedure. Some remarkable experiments were performed at the Mayo Clinic. It was found that the animals so treated, which usually died after a few weeks, could be kept alive for many months by merely regulating their diet. They were given a diet high in carbohydrate, while the feeding of meat usually killed them. Some of these animals with biliary obstruction were fed bile in an attempt to stimulate bile secretion, and it was observed that cirrhosis was more marked in these animals than in those not fed the bile. Ascites was an interesting complication which developed in some of the

dogs maintained on careful diet for a period of months. It was shown by Bollman[23] that in some of the animals ascites could be brought on quite suddenly by feeding a meat diet.

Functional and Clinical Tests: Tests for liver function have been tried and discarded over and over, and there is more discord on this subject than on almost any other functional test. We have already discussed the aminoacid test, tests with the administration of bile acids, and the Van den Bergh and cholesterol tests. The dye tests have all been the subject of considerable controversy, although in some conditions they may prove useful. The two dye tests being most used are the phenoltetrachlorphthalein and the bromsulphalein. Graham and Cole[24] now are using phenoltetraiodophthalein (isoidokon) which is good not only for gall-bladder visualization but also imparts a purple stain to the serum after it has been slightly alkalinized. A dose of about 2.5 gm. to the average adult is used and it is believed that this method of estimating the excretory function is of great benefit in determining the operative risk. Moreover, these men believe that should larger doses of the bromsulphalein or phenoltetrachlorphthalein be used, equally good results could be obtained with these two dyes. The galactose test of liver function is advanced by some as being very useful. The principle of this test is that galactose is stored immediately by the undamaged liver, but in a diseased liver it will not be stored. Forty grams are given by mouth to the fasting patient, and the urine and blood are studied for a period of two hours afterward. If more than 3 gm. is excreted in the urine, or if there is a rise in blood sugar of over 50 mg. per 100 c.c., the liver is thought to be definitely damaged. It is said to give uniformly positive results in cases of intrahepatic icterus, and is usually not positive in obstructing jaundice.

In addition to tests, Snell[25] mentions a new method now being employed at Leipzig where patients with hepatic disease are studied with a laparoscope. The laparoscope is a modification of Jacoben's thoracoscope and is used to study obscure ascites. It is possible to insert this instrument into the paracentesis incision after evacuation of the fluid and make a direct inspection of the liver and peritoneum.

Therapeutic Suggestions: The therapeutic application of many of the foregoing chemical, physiologic and pathologic observations and many experiments has had and will have far-reaching significance. Bollman[26] has shown that the liver is less apt to be damaged by chloroform and other hepatic poisons when it is well filled with glycogen, and that in the diseased liver the glycogen content is lowered. Most of the common anesthetics cause an increase in blood sugar at the expense of liver sugar. The clinical application is apparent where the question of preoperative treatment and diet are of utmost importance. Ravdin[27] thinks that morphine should not be given in cases where there is a disease of the liver, because of its tendency to produce hyperglycemia and deplete the liver glycogen. Bollman and his co-workers have also shown that the detoxifying action of the liver is enhanced when it is filled with glycogen. A high diet of carbohydrate should be considered in all cases of preoperative preparation of patients with diseased livers. Elimination of proteins may be indicated in cases of cirrhosis and calcium should be administered to the patient, with or without jaundice, who is suspected of having liver damage, or in whom such a possibility may transpire. Lamson, Minot[28] and Robbins have shown in experimental liver damage with carbon tetrachloride that repair is greatly speeded up by calcium administration.

Snell,[25] reporting from the pharmacological clinic in Vienna, states that extensive experiments are now being carried on regarding the relation of the liver to water metabolism. Here it is felt that the liver contains some hormone which stimulates diuresis. These investigations are particularly applicable in cases of cirrhosis,

and these workers are trying to prepare an active extract from the liver which has a diuretic action.

CO-RELATIONSHIPS WITH OTHER ORGANS

All of the previous data which have been reviewed has dealt almost exclusively with the liver and its diseases alone, and has not taken into consideration its remote pathologic and clinical relationships. It was noted that the bone marrow manufactured the bile pigment, that the portal blood from various areas had certain peculiar areas of distribution, that splenectomy and even removal of the gastrointestinal tract had little effect on bile production, and we have discussed the question of the pancreas and liver in sugar metabolism. But in addition to these functional relationships already listed, others of a fairly definite character have also been noted as seeming to exist between the liver and other organs. There is some relation which is present in Banti's disease between the spleen and liver; and in atrophic cirrhosis, also, a certain relationship of a rather constant character is observed. Many theories have been propounded regarding the frequent concomitant changes seen in the spleen and liver in these two conditions, as well as in some others, and on this basis a new treatment was suggested for the ascites of atrophic cirrhosis, namely splenectomy. As was previously mentioned, the work of Copher and Dick showed a definite physiological-anatomical basis for inter-relationship between the pancreas, liver, spleen and the bowel. Reineck[29] has shown an apparent inter-relationship between the suprarenals and the liver. In his experiments in prolonged cholesterol feeding, he noted that there was an apparent regulatory function of cholesterol metabolism in the adrenals, and that the liver acted as a secondary storage depot.

The use of liver extract in pernicious anemia has called forth much speculation about the relationship between the blood formation and the liver. Whipple[30] thinks that there is an increase in iron pigment in the form of hemoglobin in the body in cases of pernicious anemia, and he believes that the red cells are deficient in some constituents of their stroma, which deficiency is supplied by the liver. Therefore, since there is a superabundance of hemoglobin in these cases, the immediate formation of red cells takes place with the supplying of these liver constituents. Feeding of liver extract seems to cause the immature red cells of the marrow to mature rapidly. Simmons, Becker and McCollum[31] have apparently demonstrated that vitamin E is essential to the assimilation of iron; and, since both vitamin E and iron are abundant in fresh liver, it would seem that there is a possibility that pernicious anemia may be a nutritional deficiency in which there is some interference in the proper formation of hemoglobin. T. Fahr,[32] after a long series of experiments and necropsy studies, also concluded that the anemia could not be due to a toxic factor acting on the blood and that liver feeding was merely supplying a vitamin deficiency as in vitamin feeding reaction in persons with scurvy. Recently, West and Howe[33] have isolated, from purified liver extract, the crystalline salt of an acid which is effective in producing the remissions of pernicious anemia and analysis of this substance indicates that the acid may be betahydroxyglutanic acid. This problem may not be entirely settled but there does seem to be definite relationship existing between the liver and bone marrow in pernicious anemia.

In 1924, Allen, Bowie, MacLeod and Robinson[34] of Toronto were observing depancreatized dogs that had been kept alive with insulin for the purpose of measuring their glucose equivalent. They found that not infrequently such animals died after periods ranging from one to seven months. At necropsy, an extensive fatty degeneration of the liver was observed in these dogs. In spite of the insulin injections, the animals died after showing some very interesting clinical

manifestations such as depression, apathy, anorexia and jaundice. Bile pigments were found in the urine and a progressive oliguria was always present. Vomiting was frequent and diarrhea and blood in the stool were often observed. In 1889, Mehring and Minkowski[35] had noted that animals that were partially depancreatized were greatly benefited by adding raw pancreas to their diets. Since the advent of insulin, it has been found that depancreatized animals failed to live more than about seven months at a maximum unless raw pancreas was also added to their diets, even though the blood sugar level was controlled by insulin injections. In the explanation of this phenomenon, it was thought that the pancreas contained an enzyme which was essential for fat digestion. Penau and Simonet,[36] however, were able to keep depancreatized animals alive as long as two years with no raw pancreas in their diets. The result of these latter studies was to start an investigation to find the factor responsible for the maintenance of health in these animals who were deprived of the raw pancreas feedings. Since, as was formerly mentioned, these animals at times died with extensive fatty changes in the liver without other notable anatomic alterations, it was considered probable that the liver might play an important role in fat metabolism in these dogs. Some of Fisher's[37] depancreatized dogs that died were not given insulin in the last few days prior to their death because their urine had been sugar free and they died, not in diabetic coma but in hypoglycemic convulsions. Hedon[38] likewise observed in similar experiments which he was carrying out that when the feeding of raw pancreas was discontinued the dogs became very sensitive to insulin and it was necessary greatly to reduce the insulin dosage in order to avoid dangerous hypoglycemia. Such physiological observations strongly suggested an inability of the liver to maintain a normal blood sugar level and the presence in these animals of a remarkably extensive fatty metamorphosis would seem to indicate that the disturbance in fat metabolism was possibly responsible for the liver dysfunction.

Most observers believe that the liver does play a leading role in desaturation of fats, thus preparing them for use in the body, and it is generally conceded that the phospholipins are quite important factors in fat metabolism. In an attempt to account for the disturbance in fat metabolism encountered in depancreatized dogs, Hershey and Soskin[39] concluded that it might be due to some failure in the desaturation of fats and, since the phospholipins were so important in fat metabolism, it seemed to these workers that the liver deficiency might be due to an insufficiency of this substance. They, therefore, used lecithin in the form of egg yolk and were able, through feeding of this product, to keep depancreatized animals alive indefinitely on a diet of lean beef muscle, cane sugar, insulin and "egg yolk lecithin."

The clinical application of this investigation is still uncertain, but I have observed in juvenile diabetics, dying in coma, liver changes which are histologically indistinguishable from those obtained in the animals which were necropsied by Allen, Bowie, MacLeod and Robinson. It seems to me that it might be interesting to try out egg yolk feeding in certain recalcitrant cases of juvenile diabetes wherein fat metabolism is obviously disturbed.

In conclusion, it may be of interest to mention some observations which have been made by Drs. Schutz, Kuhn, Orr and myself regarding a rather definite interrelationship which we have found to exist between the liver and kidney in hepatic disease.

In a case of traumatic pulpification of the liver without rupture of the capsule,[40] we observed the progressive development of anuria with striking retention of blood nitrogen. The patient died after eleven days in a clinical state of uremia, and at necropsy a high grade nephrosis and extensive mucous and serous surface bleeding

were observed. Following this case, we were impressed by a somewhat similar clinical and pathologic picture observed in four patients with long-standing gall-bladder disease. Following operation and varying periods of convalescence (two to eight days), these individuals suddenly developed mild delirium, an increase in pulse and temperature with abdominal distention and progressive oliguria. The delirium progressed to coma, the urinary output became even more scanty, hemorrhages occurred from the mucous membranes, particularly the gastrointestinal tract, and finally the patients died in profound coma. Kidney function, blood and urinary findings prior to operation had all been within normal limits. In no instances were the patients jaundiced during their entire sickness. Necropsy examination in all of these cases revealed both inflammatory and degenerative changes in the liver of a marked degree. In every instance, the kidneys showed advanced degenerative tubular changes. The close similarity, both clinically and pathologically, in all of these cases led us to the conclusion that we were dealing with a definite clinical and pathologic entity which, so far as we have been able to find, has heretofore not been described.

Frequent allusions in the literature to an inter-relationship between the liver and kidney in disease have been made. Complicating nephritis in common duct obstruction has often been observed, and bile nephrosis is a well-established pathologic entity. Such investigators as Fitz-Hugh,[41] Zaffagnini,[42] LeNoir,[43] Furthwaengler,[44] Narath,[45] Staehli,[46] Haberer,[47] Gunderman,[48] Whipple and Speed,[49] Lederer,[50] Barker[51] and others have noted co-existing liver and kidney lesions, but have made no particular study of the mechanism or significance of this relationship. The kidney lesions seen in patients with liver damage in the pregnancy toxemias have been the subject of much speculation and investigation by such authors as Schmorl,[52] Benecke,[53] Shriver and Oertel,[54] and many others. Dieckman,[55] after experimentally producing the pathologic picture of eclampsia in the livers of dogs by the injection of fibrinogen into the portal vein, observed typical eclamptic kidney lesions, and numerous other experimental studies have been conducted which strongly suggest a definite inter-relationship between the liver and kidney.

The afore-related observations stimulated us in an attempt to reproduce this syndrome experimentally.[56] We were able to do this in part in animals by extensive crushing injuries to the liver and also by ligation of the hepatic artery. Unfortunately, it was impossible exactly to duplicate the clinical and pathologic picture as observed in the human subjects but the blood chemical and urinary findings could be reproduced at will. At present, further studies are being carried out along these lines. A detailed explanation of the possible mechanism of this curious relationship is impossible due to lack of space. However, we believe that there is some potent toxin elaborated by damaged liver tissue which acts more or less specifically on the kidney.

The subject of so-called "liver death" is one of greatest importance to surgeons doing operations on the bile tract. Therefore, we believe that the recognition of this syndrome as a distinct and definite clinical and pathologic entity is of some importance.

Prevention of this condition may possibly be brought about through careful liver function tests and preoperative glucose administration. The use of calcium in the postoperative course may be helpful in hastening hepatic repair. In our cases, we found that the greatest degree of damage in the liver was in that portion surrounding the gall-bladder fossa and it was suggested by Mann[57] that suturing of the gall-bladder fossa at operation might lead to additional liver necrosis, thus possibly furnishing the necessary added toxic product to cause fatal kidney damage.

We have observed several patients who did not succumb after operation but did show some evidence of renal impairment which was insufficient to result in the profound uremic picture seen in our fatal cases, and we believe that his syndrome, at least in part, is a common accompaniment of gall-bladder surgery in the presence of a long-standing cholecystitis with concomitant hepatitis.

CONCLUSIONS

Some of the most outstanding advances in the study of the liver which seem to have some definite or potential clinical application have been reviewed, and a liver-kidney syndrome which we believe to be a not infrequent complication following surgical procedures on the gall-bladder and bile ducts is briefly described.

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INCOMPLETE INTESTINAL ROTATION

BERNHARD NEWBURGER, M.D.

CINCINNATI, O.

A DISEASED vermiform appendix lying in the left half of the abdomen, as it may, as a result of a transverse position, displacement of the cecum by intra-abdominal tumor, failure of peritoneal fusion resulting in cecum mobile or mesenterium commune, situs transversus totalis or abdominis, or incomplete rotation of the colon, carries with it an enhanced operative risk. The impression has been gained in the present study that the last mentioned cause of left-sided appendicitis is perhaps not so uncommon as the reported cases might lead one to believe.

FIG. 1.

According to Stieda,[190] the first record of incomplete migration of the colon should be attributed to Treitz,[197] who in an appendix to his "Hernia Retro-peritonealis" described four such cases. We have found in our search of the literature reports by four authors[38,151,163,181] antedating Treitz, though none of these descriptions was so unequivocal as his. The embryology of the condition was known forty years before Treitz's publication.

It is most surprising that so sensational an anomalous entity as sinistrocolia should have escaped the notice of generations of observers from the earliest times to the first of the last century. Especially is this true in view of the presence of an homologous condition in some of the lower mammals which is known to have been described by the ancients and even dissected *in vivo* by some of the medieval French School[143] and of the fact that other anomalies not more striking were early observed and recorded, such as the double avian cecum[77] and the occurrence of visceral mirror transposition in animals.[7] On the other hand, one's astonishment at the apparent lack of the ancients' acuity is largely mitigated by the realization that no mention of the condition was made in twenty-three standard continental textbooks[190] of the nineteenth century and that as late as 1906 an article emanating from a continental surgical clinic, exhausting the other possibilities of left-sided appendicitis, ignored incomplete colonic rotation.

The medieval anatomists and barber surgeons were cognizant of certain of the abdominal displacements. Cornelius Gemma,[79] Fabricius ab Aquapendente,[63] Johann Schenk von Graefenberg,[178] Bonetus[15] and Morgagni[145] all gave descriptions of either situs transversus totalis or abdominis. Pierre Franco[74] noted the presence of the cecum in an enterocoele.

Shortly after Morgagni's opus was published, Caspar Friederich Wolff[211] in his

"De Formatione Intestinorum" laid the groundwork for all subsequent investigative work in this field by his epoch-making portrayal of the development of the intestine in the chick. Within the next fifty years a group of men, most prominent of whom were Oken,[152] Fleischmann[67] and J. F. Meckel,[140] to a large extent clarified the question of rotation of the abdominal viscera and brought to light anomalies due to interference with that mechanism, and Meckel, at any rate, realized that "Mehrere Faelle, wo sich diese fruehere anordnung des Grimmdarms mehr oder weniger auch in spaetern Perioden erhalten hatte, findet man von Fleischmann zusammengestellt, und richtig als Wesen derselben ein Stehenbleiben auf einer fruehern Bildungsstufe nachgewiesen." Koch[121] later brought phylogeny to bear on the problem.

This pioneer achievement has been succeeded by many sporadic reports of germane material largely necroscopic, some operative and recently roentgenographic. The two latter sources have been, perforce, incomplete in detail and could not have particularized as to vessel relationships or omental, mesenteric and intestinal minutiae.

Fig. 2.

Fig. 3.

In a consideration of this condition, the multiplicity and complexity of generically related abnormalities must not be overlooked. Risel[165] in a compilation and analysis of 49 cases of situs inversus partialis abdominis is able roughly to classify them into groups, but the borderland between groups is extremely extensive and the overlapping confusing. The gall bladder, for example, with or without liver anomalies may be left-sided, possibly associated with total absence of the spleen or with the stomach in the right hypochondrium and the large gut wholly behind or to the right of the small. Then, too, the gastric half of the umbilical loop may rotate with its appended anlagen (pancreas, liver, spleen) in a direction opposite to that taken by the distal half. Further, abdominal visceral

dislocations may or may not be associated with thoracic anomalies. Certainly the possibilities seem almost legion and a single abnormality the exception though pure cases of sinistrocolia occur as do cases of mere dextrocolia.

Though the criteria of incomplete rotation are sufficiently rigid, observation of the details has not been thorough-going, in some, at least, of the probable cases; it has been said that[76] "actually not a single case exists in which all these elements (the situation of the duodenum, small and large intestine, pancreas, and the relation of the vessels) have been observed."

Cases of reverse rotation such as Strehle's,[91] or Peignaux and Fruchaud's;[155] complete absence of rotation as in Tandler's[193] first case, in Tscherning's,[199] Thompson's[194] and Braeunig's[17] fourth case; failure of fixation of the mesentery, beautifully differentiated from true failure of rotation with retention of a mesenterium commune in Langerhans' case; such a case as that described by Drechsel[56] in which although the duodenum is crossed by the normally placed colon, the duodenojejunal angle is to the right of the superior mesenteric artery at the origin of the common mesentery; and the terminal stages of incomplete rotation known as subhepatic ceca have not been included in this study. The embryology of intestinal development need not be detailed here.

NOSOLOGY

Of the various classifications* of anomalous positions of the intestines, some are devoted wholly to restraint of rotation and none is thoroughly comprehensive. The most attractive are the etiological arrangement of Dott and the rather arbitrary one of Hecker, Grunwald and Kuhlman. The former fails to consider a dextroposition of the colon while the latter assigns to absence of rotation a condition which Dott with much more reasonableness classifies as reversed rotation of the midgut. There is a growing unanimity as to the causation of these states, but the nomenclature still lacks standardization. The anatomical grouping of DeQuervain has the clinical advantage of extreme simplicity.

* See References 12, 17, 46, 47, 52, 92–94.

PATHOLOGY

Hurst and Johnson[104] enumerate the anomalies subsidiary to incomplete rotation as follows:

1. The colon occupies the left half or less of the abdominal cavity while the small intestine lies to its right side.
2. The duodenum is elongated and its mesentery usually persists.
3. The colon does not cross ventral to any part of the small intestines.
4. The whole of the colon retains its mesentery and no part of this mesentery is blended with the great omentum.
5. The superior mesenteric artery lies dorsal to the duodenum. The rami intestini tenuis arise from its right side and the colic branches from its left, and,
6. As Hecker[92,94] points out, if 90 degrees of rotation occur in a normal direction, that is counterclockwise, so that the splenic flexure is defined, the duodenojejunal flexure is to the right of, and on the same level with, the superior mesenteric artery.

Of these items, the first is the most obvious, the basis of the roentgenographic detection, and, as a rule, the first intimation in the course of laparotomy of the existence of incomplete rotation. The mesenteric artery—duodenal relationship is crucial but frequently not determined clinically.

The retention of a mesenterium commune is often obscured by secondary fusion of the colonic serosa to the parietes or by adhesion of the ascending to the descending limb of the colon resulting in the "double barrelled appearance," so that it may be impossible to dislocate the cecum to any great extent.

As to the fourth secondarily derived anomaly there is an interesting variability. In two of Braeunig's[17] cases, in Judd's,[110] and in LeConte, Lee and Downs'[127] rudi-

mentary omenta were dependent, but without connection with each other, from both the greater curvature and a colonic segment. Eggers,[59] South,[187] Corlette,[34] Delatour[44] (III), Ludington,[135] and Schrup[80] encountered no omentum, not even rudimentary. Malcolm,[136] Hammesfahr[89] and Harris[90] describe short, free omenta attached to the stomach, the latter describing the omentum in his case as "very short (2 inches)." In the cases of Janker,[107] Eddy,[57] Lemesic and Kolisko,[129] Holmes,[90] and in Braeunig's[17] second case the omentum hung free without colonic fusion. In Treitz's[197] first specimen an omentum a hand's breadth in size was drawn into the hypochondrium and attached to the splenic flexure. Rainer[160] found the mesogaster united to the mesentery.

These bizarre omental states are not restricted to failure of normal rotation but occur in dextrocolia (DeQuervain[46,47]), ptosis of the splenic flexure (Loubat and Jonchures[134]), and so on (Schelenz,[177] Toldt,[196] Virchow,[203] and Risel[165]). Obviously, as Lemesic and Kolisko say, "The large gut then can undergo its regular fusion with the omentum only if a mesocolic segment of the transverse colon of normal cases remains in a suitable position." That even minor abnormalities are not common is evident from the observation of Poynter,[158] who found no case in 200 bodies "in which the omentum was not adherent to the transverse colon."

Toldt cites a female infant three days old described by H. L. F. Robert[168] in which there was no trace of omentum; also the case of Hlava[99] reported by Epstein[62] with absence of both great omentum and gastrocolic ligament. In this case of a five weeks old girl the stomach assumed a vertical embryonic position. He further points out that fusion of the omentum with the colon and transverse mesocolon does not occur normally under certain conditions: "The conditions for this lie in extraordinary positional relationships of the stomach to the large gut . . . " He calls attention to the analogy of the lower mammals and the human embryo of the third month in respect to colonic-omental relationship.

The mesenteric radix, which, especially in those cases with obstruction from volvulus is extremely narrow, is described in some of the reports as assuming a downward course from right to left, the inverse of the usual insertion.

ETIOLOGY

Theories as to genesis of positional anomalies of the intestinal tract, and specifically of incomplete colonic migration, have advanced from the belief that "the situs rarior [is] the result of God's punishment, [or] the work of demons"[122] to a mechanistic explanation which is currently accepted. Phylogeny and ontogeny both should make one anticipate an incidence of failure of complete adult human development even greater than indicated by the numerous reports of subhepatic ceca and cecum mobile. W. H. Flower[69] found that the human intestinal pattern "is perfectly exceptional among mammals." Koch[121] correlated some human intestinal anomalies with the normal state of birds and fish. According to Fredet[76] "torsion is normally lacking in a great number of mammals." Cuvier[40] noticed the almost universal absence of intestinal rotation in the carnivora whose intestinal canal in the main resembles that of the bat. Some have thought that the mere lengthening of the tube should account for the normal presence of rotation in the relatively few species in which it does occur, but as this lengthening takes place both in animals which are normally devoid of intestinal migration and in humans who are also without the twist, it obviously cannot serve as an etiological factor. Again, the right-sided position of the duodenal loop and the liver mass has been assumed as the obstacle to rotation in the clockwise direction, but such cases have been recorded. Ekehorn[60] felt that the rapid duodenal development might influence

rotation. Klaatsch[119] attributed the determining roles in the development of the adult's situs abdominis to the liver and spleen. The theory of embryonic peritoneal adhesions as the source of restraint of rotation was long in vogue and was advanced, seemingly with good reason, by many of the Scotch-English school. Dott[52] has clearly pointed out the fallacy here. Serres quoted by J. Reid[163] attributed the position of the caput cecum in the right iliac fossa to the descent of the testis or ovary. Persistence of the right rather than the left omphalo-mesenteric vein has been hinted at by Lochte[132] as the cause of non-rotation; this might occasionally account for an isolated case but atypical development of the portal system is certainly no constant concomitant of incomplete colonic migration though extremely frequent in otherwise normal people. In short, until 1915, no greater success attended the attempts at explanation of non-rotation, and its normal counterpart rotation of the intestines, than had similar efforts in the domain of situs transversus totalis and partialis.

At that time Frazer and Robbins'[75] passive mechanical theory was advanced and has received widespread acceptance through its lucidity and its logical attack on the problem of rotation. Although this hypothesis is intrinsically most difficult of proof some formidable indirect evidence is at hand to lend it great credibility. Their theory is briefly as follows: Rotation is initiated through downgrowth of the right hepatic lobe and the consequent depression of the proximal limb of the intestinal loop to the right in the physiological hernia by the above conditioned descent of the secondary left umbilical vein which runs diagonally across the ventral aspect of the proximal limb from the left side of the umbilical opening to the right lobe of the liver. Also, in this first stage, the two fixed points, the duodenum, with its bow-causing pancreas, the "colic angle" with its transient retention band, and the duodeno-colic isthmus are delimited.

In the second, critical, stage, during which the intestines return from the extra-embryonic to the intra-embryonic celom and definitively assume their position, the proximal limb of the loop reenters the relatively enlarged abdominal cavity, with its decreased pressure, first. This happens for two reasons: the crucial items of the theory. First, because the intestines cannot re-enter en masse, being hindered by the rather rigid walls of the umbilical orifice (recti abdominis and the central hepatic notch); and, second, because the ileocecal region, especially the cecum, forms a definitely larger and less flexible and ductile mass than the small intestinal coils (proximal limb) and "that this shape of the colon must operate against its passage through the narrow neck of the sack." Hence, the proximal loops of the small intestine return to the right of the median mesocolon, which forms a sagittally placed septum. This they push up, to the left and dorsally. Further, these coils are directed below and to the left of both the temporarily fixed mesenteric trunks and the distal limb (colon), causing rotation. When the cecum, following the small intestines, returns, it at first lies on them and later, due to pressure, behind them near the dorsal wall, though not adhering. As will be noted, the intestines do not rotate about the mesenteric axis, but the first returning coils pass beneath it.

The third stage comprises fixation of the mesocolon and mesentery and extension of the cecum from a subsplenic or subgastric position to its adult locus.

Dott[52] on the basis of this theory says that "a departure from this sequence of return is the only possible explanation of perversion of the second stage of rotation" and that "the factors which would derange this order are such as would render the small intestine more difficult of rotation or the cecum or the umbilical orifice so large that they could be reduced with equal facility"; and further, specifically, in regard to the cause of incomplete rotation of the midgut loop that "it appears most

likely that the colon and cecum return first through a lax umbilical ring, carrying with them the lower end of the ileum and superior mesenteric artery. The small intestine immediately following on will not tend to pass behind the artery since the latter is not now held forward to the umbilicus, but rather to displace it and the large intestines to the left."

Although this and the derived explanations are most attractive, the suspicion of a more basic disturbance as the cause of failure of rotation is contained in Risel's[165] statement that no complete inversion of the abdominal viscera has been authoritatively reported without some accompanying abnormal thoracic feature; and, too, the almost interrupted series of transitional forms between situs solitus and situs transversus, as indicated in his collected cases as well as those of Toldt:

Es kann ferner allein der Magen mit seinem Anhangsgebilden (Mesogastrium, Milz, Duodenum, Pancreas) verkehrt gelagert sein, dadurch dass sich die Magenschleife Toldts in entgegengesetztem Sinne gedreht hat, oder auch allem der Duenn-und Dickdarm infolge von umgekehrter Drehung der Nabelschleife. Diese, wenn man so sagen darf, reinen Formen koennen sich untereinander kombinieren. Mit der Umkehrung der Magenschleife kann eine solche der Leber oder eine solche des Darmes verknuepft sein (bei sonst normaler Lage der Brustorgane und der grossen gefaesse der Bauchhoehle), oder endlich konnen auch alle drei Formen zusammen vorkommen.

Martinotti[138] is quoted as having marked the frequency with which inversion of the cecum and colon was associated with malposition of the other abdominal organs and having concluded that "the position of all these organs might be attributable to one and the same cause." There can be but little doubt but that these cases of situs inversus abdominis to which Risel and Martinotti refer are closely allied to, if not of identical order of pathogeny with, instances of colonic non-rotation. However, Toldt was of the opinion that in isolated deviations of alimentary segments, such as incomplete colonic rotation, locally acting factors would be the cause and it is not impossible that Frazer and Robbins have premised them.

INCIDENCE

The relative rarity of incomplete intestinal rotation is difficult to confirm but is vouched for by Mayo,[139] J. B. Murphy,[149] E. W. Andrews,[5] Schelenz,[77] Hurst[104] and others. Risel, on the other hand, says of the closely related cases of situs inversus abdominis that their number is by no means so restricted as one would judge from the majority of reports. An idea of the frequency of its occurrence may be arrived at by a consideration of ratio:

A search of the literature of the last four or five years had disclosed some twenty-six published cases of this sort (complete transposition). Their number in a few years compared with the number of other kinds of misplaced appendices reported during a period of a hundred years makes it apparent that the latter condition must be very much more unusual than the former.[180]

At the time of Mayo's report of 4 cases of appendicitis associated with failure of the colon to rotate, 3 cases had been operated on at the Mayo clinic which were complicated by complete visceral transposition. Warren Cole reports no cases of incomplete intestinal rotation in 45,000 admissions to the St. Louis Childrens Hospital. Larimore on the basis of 10,000 gastrointestinal roentgenological studies placed the incidence of anomalous intestinal rotation, presumptively including non-rotation, malrotation and reversed rotation, at less than 1/10 of 1 per cent and thought it of almost as rare occurrence as complete transposition of which he has seen but 2 instances. A compilation* of 12,072 observations in which the authors were interested primarily in the position of the appendix, furnished an incidence of incomplete rotation of 0.041 per cent. Treves[198] found a subhepatic position of the cecum in 2 per

* See References 1, 95, 100, 144, 184, 189, 205.

cent. Liertz's[131] figures are not included as it is impossible to specifically account for his 0.7 per cent left-sided appendices.

A survey of the literature revealed 151 cases of incomplete rotation not including 14 doubtful clinical instances and 12 in which the incomplete rotation was combined with other major visceral abnormalities. Of this total of 177 cases, 40 were instances of appendicitis. In 1926 Herrman[96] found 319 cases of situs inversis totalis. Roughly, then, incomplete rotation is about one-half as frequent in occurrence as total visceral transposition. The extremely high proportion of appendicitis in the recorded cases is most suggestive of a much higher incidence of the condition than the reported cases would indicate.

Foerster[70] made the observation that the midgut in cases of extroversion of the bladder complicated by intestinal openings often remained at the three or four week embryonic level.

In 6 cases of situs transversus totalis* the additional anomaly of incomplete rotation was present, resulting, of course, in a dextrocolia.

In a group of 111 cases of incomplete rotation in which the sex was mentioned, 59 were male and 52 female, showing, as would be expected in a larger series, a tendency to equalization as compared to "about three males to one female" as found by Dott in 48 cases of all types of anomalies of rotation. In the group with appendicitis the distribution as to sex was equal.

In 92 of the reported cases the age of death or operative interference was as follows: 7 a few days premature to three months; 16 from three months to fifteen years; 49 from sixteen to forty-five, and 20 from forty-six on. The extremes of age are represented from prematurity to eighty-four years. Appendicitis in the abstracted cases occurred from the fifth to the eighty-fourth year. Dott, in the more catholic group including mal and reversed-rotation and failure of peritoneal fusion, found a large group (6 of 13) with the occurrence of symptoms of obstruction within a few days of birth.

* See References 24, 98, 171, 183, 200, 203.

CASE REPORT

Male, aged fourteen, white.

Family History: Irrelevant except that four sisters had been operated on for appendicitis.

Past History: Unimportant. Review of systems negative. No alimentary complaints of any nature, except as noted under Present Illness.

Present Illness: Onset November 29 with slight pain in the right lower quadrant. This pain was barely perceptible and the patient continued at school. The following day shortly after noon the pain became increasingly severe and colicky in character. There was no radiation. About 3:30 P. M. severe persistent vomiting began; each bout of vomiting being followed by some relief.

This is the fifth similar attack the patient has had during the last year. They have each lasted about two days, forcing the patient to remain in bed. Each has been accompanied by pain restricted to the right lower quadrant, nausea, vomiting, and during the first attack in December, 1927 a frequent desire to go to stool.

Physical Examination: That of a poorly nourished boy lying in bed complaining of slight abdominal pain and nausea. Temperature 98.6°F.; pulse 78; respirations 20. Tongue coated. P.M.I. 7.5 cm. from midline in fifth interspace. Abdomen soft, scaphoid, and tympanitic throughout. No masses or rigidity noted. There is moderate tenderness over McBurney's point and over the bladder region. There is hyperesthesia over McBurney's point. The findings are otherwise negative, no anomalies such as polydactylism or syndactylism being noted.

Laboratory Findings: Urinalysis: acetone positive, few pus cells. Blood count: W.B.C. 21,600; P.M.N. 90 per cent; S.L. 10 per cent.

Operation (Nov. 30, 1928): McBurney's incision. Dilated and injected loops of small bowel seen on opening peritoneum. No cecum or colon found, nor was any encountered on looking up under the liver, where the small intestinal coils were collapsed and not injected. Incision enlarged to a Weir. Retraction to the left uncovered the cecum lying about 5 cm. to the left of the midline and on a level

with the iliac spine, pointing caudad and to the right. It was rather firmly fixed and did not permit mobilization. The appendix was free, normally attached to its mesentery, acutely inflamed and covered with patches of fibrin. There were about 50 c.c. of clear, straw-colored fluid in the pelvis. The omentum was seen in the upper left half of the abdomen, but its relation to stomach and colon was not determined. Appendectomy was performed according to the usual carbolic-alcohol technique and the stump inverted with a Runion silk stitch, and the mesenteriolar stump covered with cecal wall with two mattress sutures. The colon ran up and to the left. No further exploration.

The postoperative course was smooth, healing per primam. The maximum temperature was 100.6°F. on the third day. Discharged on December 9, 1928. Since then no abdominal complaint up to March, 1932. X-ray films taken postoperatively show the course of the duodenum (Fig. 1) and colon (Figs. 2 and 3).

Case reports of appendicitis with incomplete migration abstracted from the literature: LeConte, Lee and Downs,[127] Hurst and Johnston,[104] Malcolm,[136] Pleth,[157] Eggers,[59] Baumgartner,[10] Walther,[206] Sokolova,[185] Corner,[36] Case,[28] St. Clair,[174] South,[187] Klopp,[120] Ashhurst,[9] Mayo, 4 cases,[139] DeNancrede,[45] Corlette,[34] G. R. Fowler,[72] R. H. Fowler,[73] Delatour, second and third cases,[44] Sturgis,[192] Johnson,[108] Brewer,[18] Blake,[13] Bloch, second case,[14] Lefebvre,[128] Weil and Detre,[209] Gillen,[83] Schrup,[180] Harris,[91] Waugh, fourth case,[207] Ostroumow and Kremer,[153] Edington,[58] Brouet,[19] Woolsey, 2 cases.[212]

Questionable cases of appendicitis with possible incomplete rotation: Fowler, 2 cases,[72] Harris,[90] Dowd,[53] Vazelle,[202] Fournier,[71] Gerster,[80] Proust and Paris,[159] Karewski, first case,[115] Eliot,[61] Walther, first case,[206] Damianos,[43] Crook,[37] Rawson.[161]

Cases complicated by other congenital positional anomalies not associated with appendicitis: Lochte,[132] Bujalski, twentieth case,[24] Schelenz,[177] Moser,[147] Perls,[156] Marchand,[137] Geipel, 2 cases,[78] Hickman, first and second cases,[97] Ssobolew, fifth case,[188] Valliex, ninth case.[200]

Case of incomplete intestinal rotation not associated with appendicitis and derived from x-ray, postmortem and operative material: 1. Necropsy: Reid, two cases,[163] Simpson's twenty-ninth case,[183] Neugebauer,[151] Chiene,[30] Fagge, fifty-seventh case,[64] Lockwood,[133] Wilks,[210] Berry,[11] Jukes,[111] Farabeuf,[66] Young,[213] Schiffendecker,[179] Groenroos,[86] Stieda,[190] Treitz, four cases,[197] Gruber, two cases,[87] Rostowzew,[172] Holmes,[101] Riechelmann,[164] Sencert,[181] Casariego,[27] Rainer, two cases,[160] Reid,[162] Descomps,[48] Ingebristen,[105] Lemesic and Kolisko, three cases,[129] Hamann,[88] Huntington, four cases,[103] Flick,[68] Smith, five cases,[184] Eddy,[57] Morosoff,[146] Jaboulay,[106] Sauerbeck, second and third cases,[175] Sawin, first case,[176] Tandler, second and third cases,[193] Johnston,[109] His,[98] Faltin,[65] Clement,[31] Cruveilhier,[38] Mole,[142] Borukhin,[16] Michel,[141] Curschmann,[39] Pan.[154]

2. Roentgenogram: Corlette,[35] Doehner,[51] Altschul, two cases,[2] Roberts,[169] Keaton,[116] Nessa,[150] Hurst and Johnston, second case,[104] Janker, fourth case,[107] LeWald, four cases,[130] d'Amato,[4] Altschul,[3] Dillenseger,[49] Gilbert,[82] Diocles,[50] Vasselle,[201] Darbois and Sobel.[41]

3. Operation: DeQuervain,[47] Armstrong,[8] Bulman,[25] Judd,[110] Hecker et al., first case,[93] Arce and Cassinelli,[6] Downes,[55] Janker, third case,[107] Waugh, first and second cases,[208] Voglein,[204] Mayo, fourth case,[139] Hammesfahr,[89] Rixford, first, second, and third cases,[167] Downes,[54] Brouet and Caroli,[20] Corkill,[33] Grant,[84] Ludington,[135] Grant,[85] Gibson,[81] Thomson,[195] Robineau,[170] Hecker et al., second case,[93] Kiffer,[118] Davis.[42]

COMMENT

Besides those cases listed as questionable in this report (including Hamann,[88] Morosoff,[146] and Sauerbeck, second case[175]), Fredet considers those of Cruveilhier, His, Toldt (not included in this series), Moser and Wilks as doubtful as regards incompleteness of rotation.

The median position assumed by the descending colon in the roentgenograms of the barium enema is probably due to free mobility resulting from an extension of the common mesentery to the lower rectosigmoid. This position was not observed in roentgenograms accompanying other articles reviewed.

In the cases of appendicitis a most infrequent correspondence between the ectopia and signs were found. No explanation of this capriciousness can be found in

the work of Kulenkampff,[123,124] Bruening,[21–23] or Kappis.[112–114]

The findings of Senglar,[182] Chauveau,[29] Mueller,[148] Bloch,[14] Hornicke,[102] Fowler,[72] and Kelly[117] are of the same tenor. Waugh's sign of emptiness of the right iliac fossa was not confirmed.

A mortality of about 10 per cent in the group with appendicitis in all likelihood fails to reflect the true state of affairs, as almost one-fourth of those dated from 1907 on, were complicated by either a general or localized peritonitis, indicating possible difficulty in arriving at a diagnosis with consequent late intervention.

SUMMARY

A case of sinistrocolia proved by operation and roentgenography to be due to incomplete normal rotation of the intestines to about 90 degrees is recorded. Only cases of incomplete normal rotation from about 90 degrees to approximately 135 degrees have been embraced in this series, as lesser or greater degrees of rotation result in either complete non-rotation or subhepatic or subpyloric ceca. One hundred and seventy-seven cases, of which at least 15 are dubious, are abstracted from the literature. Of these about one-quarter are complicated by appendicitis and one-tenth by intestinal obstruction. The approximate frequency of incomplete rotation in proportion to complete transposition is estimated. The difficulty of diagnosis of appendicitis in incomplete rotation of the colon is noted. The impression is gained that the condition is uncommon but not rare.

Since this article went to press two further cases of incomplete intestinal rotation have been seen by the author in von Haberer's Clinic in Koeln. Both were adult males, one operated on for gastroduodenal ulcer and the other for peritonitis of unknown origin.

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ADIPOSIS DOLOROSA*

CLYDE L. WILSON, M.D.

BOSTON, MASS.

EVERY physician, in the course of his practice, is consulted by obese individuals complaining of painful areas of fat. The question of what causes the pain and what should be done about it always arises. Because of this, an attempt has been made to look up some of the literature on the subject and to offer an explanation for the syndrome of symptoms known as adiposis dolorosa.

Adiposis dolorosa is a syndrome of symptoms associated with fat metabolism and was first described by Dercum in 1892 from a case in the wards of a Philadelphia Hospital. This was preceded by a case report by Dercum[2] in 1888, and one by Henry in 1891. Dercum considered the disease a clinical entity and named it adiposis dolorosa because of its most characteristic symptom—painful fat.

In his original paper, Dercum[1] described 3 cases of the disease with the gross pathological findings of 2 cases, both of which showed abnormal thyroid glands. In one the thyroid was enlarged while in the other it was indurated and smaller than normal. Both glands had calcareous deposits in them. This led Dercum to believe that the disease was a clinical entity on the basis of a "disthyroidia." In 1902 Dercum and McCarthy[3] described a case of adiposis dolorosa with complete autopsy findings, the chief pathological lesion being an "adenocarcinoma" of the pituitary body. The thyroid was normal. Following this several cases were described, many of which showed abnormalities of the pituitary gland.[5,6,7,10]

Cushing[13] in 1912 first questioned the rationale of calling the disease a clinical entity, stating that, in his opinion, many cases reported as adiposis dolorosa "are actually examples of disturbed metabolism secondary to disease of the ductless glands." He presented a case having all the characteristic symptoms of Dercum's disease including increased sugar tolerance. His case improved on treatment with extract of the whole pituitary gland. The pituitary body was found to be enlarged at operation. Citing this case as an example, he pointed out the fact that the disease probably began as a disturbance of the pituitary body affecting the thyroid secondarily. He explained the nervous disorders on a hypopituitary basis suggesting that many neuroses may be associated with ductless gland disturbances. Winkelman and Eckel[4] in 1925 reviewed the literature and found that of the 200 cases of adiposis dolorosa reported only 15 had necropsy reports. They added a case of their own. Of these 16 cases, 2 showed no changes in the ductless glands. Of the 11 cases in which the pituitary body was examined, 8 showed changes in that gland. The thyroid was abnormal in 12 cases, the changes being calcareous deposits, atrophy or hyperplasia. Nine cases showed atrophic, "sclerotic" or cystic sex glands. In 3 cases the suprarenals were abnormal (unilateral hyperplasia, adenoma) and the pancreas showed abnormal changes in 2 cases (sclerosis and fatty invasion). From this data they concluded that the disease is really a polyglandular disorder, causing the disturbed fat metabolism. This view has been quite generally accepted.

Purves-Stewart[14] in his new book classifies the disease among the tropho-neuroses, probably due to disturbed activity of the thyroid and the posterior lobe of the pituitary body. Labbe and Boulin[8] reported a case of adiposis dolorosa almost parallel to that herein reported. They could not attribute the psychic and

* From the Lahey Clinic, Boston, Mass.

nervous disorders to any one thing which could at the same time cause obesity. Newburgh[12] can see no reason why the disease cannot be explained on the basis of energy intake. He points out that the painful areas of fat may be made to disappear on regulation of the diet alone and feels that it is unnecessary to seek some special metabolic activity to explain the distribution of the fat.

Whether the disease may be explained upon the basis of disturbed metabolism secondary to changes in the ductless glands, or on the basis of energy intake alone, is not entirely settled. It seems more reasonable that both factors come into play and that the disease is really a syndrome of symptoms in obese people.

Adiposis dolorosa is more common in the female than in the male in the proportion of five to one. It is more common after the menopause, between the ages of forty-five and sixty years, although it may occur at any time between the ages of eleven and seventy-eight years. Dercum's 3 patients were fifty-one, sixty-four and sixty years old, respectively, all three being females. Various etiological factors were described by the early writers. These included syphilis, tuberculosis, alcoholism, acute infectious diseases and operations upon the sex organs. It is well known that there is a familial tendency toward obesity as well as toward nervous disorders. Both may occur in the same family. Several authors have reported examples of a definite familial tendency of adiposis dolorosa.

Dercum's disease has been classified into three groups according to the distribution of the painful fat. These are (a) the nodular type, the least common, (b) the circumscribed diffuse type, the most common, and (c) the generalized diffuse type, the next most common. The parts most commonly affected, in the order of their occurrence, are the trunk, shoulders, arms, thighs, forearms and legs. The face and hands are rarely affected. In some cases the painful fat is sharply localized, resembling painful lipomata. Deep furrows may separate the lumps of fat and the skin is uneven over them. Sometimes aprons of fat reach to the knees. Nearly all of the patients are overweight.

The disease is slow and insidious in its onset. There develops an excessive deposit of fat diffusely over the trunk, and extremities, or in irregular deposits of fatty tumors which vary in size from 1 to 4 inches in diameter, painful to the touch, and somewhat elevated above the surrounding fat. The overlying skin may be normal in appearance, slightly reddened, or more often congested, and rarely with distended veins. The color of the tumors may be due to vascular changes. These skin changes finally disappear leaving indurated areas of fat tissue. Usually there are recurrences of the skin changes and pain until there is a fairly distinct nodular tumor of considerable resistance and consistency. The fat has been described as feeling like a "bag of worms" or a "caked breast."

The pain in the fatty masses may vary from tenderness to pressure to violent attacks of spontaneous pain which have been described "as though a dog were tearing the flesh from the body." There is usually generalized asthenia varying from fatigue to extreme prostration. The psychic phenomena include instability, melancholia, epilepsy, impairment of memory, hysteria, mental confusion and true dementia. In addition the following conditions have been described as symptoms associated with adiposis dolorosa: (1) parasthesias and areas of anesthesia, (2) diminished tendon reflexes, (3) vasomotor phenomena such as flushing and cyanosis of the skin, tendency to bruise easily, purpura and spontaneous hemorrhages from the nose, stomach and uterus, (4) trophic change indicated by the slow healing of ulcerations, (5) myxedema, (6) secondary anemia, (7) arthropathies.

The differential diagnosis is concerned with distinguishing this from other forms

of diseases associated with altered fat metabolism. In adiposis cerebralis (Froehlich's syndrome) there is a moderate deposition of fat, the formation of the body is feminine in the male as well as in the female, the genitals are ill developed, and in the males the sex characteristics are altered especially in the scanty growth of hair on the pubes, in the axillae, and on the face. In the female the altered sex characteristics are seen mostly in the small size of the breasts and genitals. Adenolipomatosis[15] is an unusual condition characterized by either general or large tumor-like masses of fat widespread over the body. Histologically this fat shows lymphoid infiltration. In this disease there is asthenia, sometimes to emaciation, hypochondria, enlargement of the spleen, and the blood shows a decrease in the number of small mononuclear leucocytes. Lipodystrophia progressiva[15] is a rare form of obesity in its full form. It begins in childhood and affects girls almost exclusively. In this disease there is an emaciation of the upper portion of the body with almost complete disappearance of the subcutaneous fat, and an obesity of the lower portion of the body. The general health may be good but there are often psychic phenomena. Lipomatosis of the pseudohypertrophic form of muscular dystrophy[15] shows the dystrophic muscle groups to be enlarged by marked infiltration of the fat between the muscle bundles. There may also be unusual fatty deposits in the mammary and inguinal regions.

The prognosis of Dercum's disease as to life is good, but as to cure is bad. Dercum and McCarthy's case ran a course of thirteen years. The tenderness along the course of the nerves usually subsides as the disease advances. The fatty masses become larger and more generalized, and the asthenia and mental disorders progress. Ultimately the patient dies of some intercurrent disease or complication.

The treatment resolves itself into the treatment of obesity or lipomatosis and the associated conditions. Surgical removal of the painful fat areas wherever possible is indicated. Restriction of diet is of distinct benefit as is the administration of thyroid or pituitary extract. If syphilis is present it, of course, should be treated. Salicylates are often of benefit in the treatment of the pain.

The following is the report of a case of the nodular type of adiposis dolorosa:

Mrs. G. P., an American housewife, of forty-three, came to the Lahey Clinic complaining of painful tumors on the arms, and abdomen, and pains in the legs. Five years ago the patient first noticed a soft tumor beneath the left breast. This was removed surgically and was found to be a fat tumor. Two years ago a similar tumor appeared upon the left forearm. It grew to about the size of a walnut and then spread out becoming less prominent. At the same time similar smaller tumors of a like nature developed nearby. About three weeks before coming to the Clinic the patient noticed a soft swelling in the right biceps region, on the right forearm, and on both sides of the chest. All of these areas were painful. At times there were sharp pains running through the extremities, and through the areas of the tumors. There were also painful areas in the thighs. The patient was quite worried about financial matters, and regarding the health of herself and husband. She had gained 20 pounds in the past fifteen years. She was afraid that she was becoming insane. She had had a myomectomy in 1911 and a postoperative hernia repair in 1912. An exploratory laparotomy had been done following an attack of "hysteria" in 1913. Tonsillectomy was done in 1930. About two years previously she suddenly became paralyzed in her legs while on the beach. She had the will to move the legs but could not. A physician was called and after examining her told the patient that he could find nothing wrong with her and advised rest. These orders were carried out and after about two weeks the patient was able to resume her normal activities. She had been married fifteen years, with one miscarriage. Her mother died in an insane asylum at fifty-three years of age. Two great-grandfathers became insane and committed suicide

by cutting their throats. Her mother's four uncles became insane and committed suicide. The patient's brother is high strung and nervous. The patient's father is large in size and of a stable temperament.

The patient was an obese female, weighing about 185 pounds. The examination was essentially negative except for a carious right lower premolar tooth. There was slight diffuse tenderness to pressure over the entire abdomen. The abdominal wall was thick and in the right lower quadrant, in the fatty tissue, there was a soft painful nodule about 2 cm. in diameter, barely palpable. On the volar surface of the left forearm there was a soft painful nodule about 2 cm. in diameter just distal to the cubital fossa on the radial side. It was slightly tender, movable, and resembled fat tissue. Similar, though smaller, areas were present just distal to this one, and on the volar surface of both wrists. The hands, feet and face did not show evidence of excessive fat. The reflexes were normal. A biopsy of the nodule on the forearm was done and the pathological report was lipoma.

This case is an example of the nodular type of adiposis dolorosa. All of the cardinal signs and symptoms were present: obesity, pain and mental manifestations in a middle-aged woman. There is a distinct background for her nervous temperament in her family history. Her worries over impending insanity and over financial matters helped to accentuate her neurosis. The pain is the most difficult to explain. Pain in the abdominal wall of obese persons may be due to stretching of the nerves that supply it. No explanation is offered for the pain in the fatty tumors of the forearm.

SUMMARY

That adiposis dolorosa is not a clinical entity is shown by the fact that there have been no findings consistent in all of the cases reported. It seems more reasonable to assume that the condition is one of either simple obesity or lipomatosis associated with neurosis or neurasthenia, and that the pathological conditions that have been found in these cases that have come to autopsy were incidental. Whether obesity is to be explained upon the basis of energy intake alone or energy intake plus endocrine gland disturbances is not entirely settled. The preponderance of evidence points towards the latter. This is borne out by the disease adiposis cerebralis (Froehlich's syndrome) which is a disease of obesity associated with consistent pathological findings in the pituitary gland. On the other hand, improvement in cases of adiposis dolorosa has been observed where the diet alone has been reduced. It is well, therefore, to look upon adiposis dolorosa as a syndrome of lipomatosis or generalized or localized obesity associated with neurasthenia or neurosis. The treatment is symptomatic. A case of the adiposis dolorosa syndrome is reported.

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SURGICAL METHOD FOR THE RELIEF OF PAIN*

PROF. V. I. RAZUMOVSKY, M.D.

BESHTAU, ESSENTUKY, RUSSIA

MODERN surgery, having eliminated pain in operations, is now studying methods of alleviating pain in various chronic diseases. Dissection of nerves, in neuralgia, has long been in practice. Operative treatment of neuralgia is at present one of the most perfected chapters in the annals of surgery, but it is far from being completed. It is true that even in the most severe cases of neuralgia in nervi trigemini we may depend upon the operation consisting in dissection of the root of n. trigemini (Frazier),† but this operation is difficult and therefore not practicable for many surgeons. In recent years our physiological conceptions of the pathogenesis of pain have somewhat changed. If it is incontestable that in neuralgia the sensory nerves are the *sedes morbi*, it is the more probable that the sympathetic nervous system has a certain role in the process. Now we are well aware that the n. sympathicus has the main role in the origin of visceral pains, but one cannot deny its participation in other pains, both "perivisceral" (Lemaire) and generally peripheral. This is confirmed both in experiments (Förster, Abrajanoff and others) and in some clinical observations, for instance, those of Burrow.

Personally I am inclined to believe that pain is a complex sensation, combining the function both of the sensory nervous system (including the centers and the intermediate stations) and the sympathetic system. The peripheric receptors contain the endings of the medullated and non-medullated fibers (Förster); further, we know that susceptibility of receptors ("threshold stimulus") depends upon the vessels being filled with blood, as particularly stressed by Förster, and upon some reflex influences, as especially proved by Lemaire's investigations.

All these physiological and clinical data convince us that we can eliminate pain in neuralgia not only by means of dissection of sensory nerves, but also by other means, such as, for instance, various effects on the sensory receptors in neuralgia of peripheral origin which apparently predominates and on the pain conductors and the ganglion centers.

Based upon these observations, we have developed a new method for the treatment of neuralgia in n. trigemini, namely through the irrigation of arteria carotis (communis and its bifurcations, i.e. the beginning of carotis externa and interna) aiming to affect the nerves in this artery and around it which reach the peripheral ramifications, the capillaries, and perhaps also the receptors. Clinical experience, published by Nazarov and myself gave pretty good results.‡ We have made numerous observations of neuralgia cases cured by alcoholization, some cases having been observed during a period of two years. But we have also observed some relapses: for instance in one woman patient in whom neuralgic pains were cured by alcoholization, they recurred two years and seven months later; a second irrigation removed them completely. Apparently, it is very important that the irrigation includes the portion of bifurcation. In most of the cases in our practice the neuralgia was in the second

† I made the first operation by Frazier's method in Russia in 1907. In 1909, while operating on a patient suffering from neuralgia, with vision in one eye only (on the side of the neuralgia), I made a partial resection of the nerve root (saving the first branch). Later I perfected this method of Frazier's, further developing its technique (*Ann. Surg.*, 1929). In this conservative method, however, there is a risk that the operation will be without results (this has been noted in the literature).

‡ The published material covers 30 cases; up to the present we have had experience with 40 cases.

* Translated from the Russian by Tatiana W. Boldyreff.

and third branches; we had only one case in the first branch and in this case alcoholization also proved successful. In some cases we combined alcoholization of the artery with that of the nerve through injections into the *foramen ovale* and *rotundum* (Braun). It seems that for some cases this combined operation produces a better effect. In this manner through a simple harmless operation within the powers of any physician we have acquired a powerful means for the treatment of one of the most terrible diseases.

Another similarly painful affliction is that of angiosclerotic gangrene (Buerger's disease) which has become so frequent in recent years. About five years ago, in the course of treatment for this disease, I began using alcohol injections into the nerves, and later irrigation of *a. femoralis* by alcohol; at present we have data for several scores of cases treated in this manner, removing torturing pains and often improving the general condition of the patient as well. Recently we have occasionally tried the combined irrigation, i.e. irrigation of *a. femoralis* and *n. ischiadicus*, and the results, as far as the pain is concerned, were still better. We have also successfully applied combined irrigation in other painful diseases such as perforative ulcer of the foot, causalgia and others.

A year ago we also began using irrigation of *n. ischiadici* in cases of ischias, not injection inside of the nerve, but irrigation of its surface to the extent of from 8 to 10 c.c.* Good results were secured in 5 patients, one of whom, however, suffered a relapse six months later.

Alcoholization of nerves also gave good results in cases of gastralgic pains. Without dwelling at length on the pathogenesis of gastric pains, we shall but note in passing that (1) if the ulcer does play a very important role in the origin of such pains, it does not exclude other causes (Buettner, Bergmann, Walton and others) and (2) gastric pains may be stopped through the effect on the gastric nerves. Many references are to be found in medical literature on the effect on the gastric nerves and a number of methods have been offered for the dissection of nerves and extirpation of the ganglion semilunare inclusively (Latarjet, Biercher, Wertheimer, Gomain, Janu, Braun, Pribram and others). But all the operations offered for the nerves are complicated and traumatic; Latarjet's operation is known to have resulted in death in some cases. The method we offered in 1926 and used extensively (80 cases) is simple and not dangerous; it consists of an injection of alcohol into the minor omentum. Our results are highly satisfactory and we have even had striking cases of cure of chronic pains of long standing; many cases have been under observation for a number of years. I am inclined to believe that treatment of pains after extensive "palliative" resection (Kelling, Finsterer, Floercken and others) is to be explained by the inevitable removal of nerves in the resection. Nazarov has experimentally and clinically established the interesting fact that gastric acidity is diminished after the injection of alcohol in the minor omentum; extensive resection, in cases of ulcer, is being done with this object in view. Even more practical is the use of alcoholization of the gastric nerves in gastric pains not traced to the effect of an ulcer; such cases are described by Walton, calling them "relative paralysis of all vagal impulses" and so forth. Alcoholization is used either alone or in combination with other operations on the stomach. I shall not describe in detail other painful processes such as hepatalgia, neuralgia, painful tumors and so forth, which were also treated in my clinic by alcoholization of nerves (injection into the hilus, etc.) with good results; although these were detached cases, they incite us to further study and investigation in this direction.

[Concluded on p. 496.]

* This method is based on the Negro's discovery of peritruncal sympathetic nervous network on the surface of the nerves. I believe that Lange's method for treatment of ischias consists of affecting not the nerve itself but the peritruncal nervous reticulum. This is partly the case also with the effect of traction in the nerve.

PRACTICAL APPLICATION OF THE MICROPHONE IN THE TEACHING OF SURGERY

RAFE C. CHAFFIN, M.D.

LOS ANGELES, CALIF.

EVERY medical school at the present time is making every effort to better equip their students for the care of the sick. The medical graduate with his brain so crammed with knowledge is what one might call a "general specialist." He has a good theoretical knowledge of not only medicine and surgery, but, also, all the specialties.

Most of the present day medical schools require an interneship before granting the diploma,—a feature of great value,—and give the student some opportunity to make a practical application of some of his vast store of knowledge.

The interneship and resident plan came about as a result of the teacher's recognition of the lack of sufficient practical work in the medical school. While our schools now are not only keeping up, but actually increasing the hours for the study of the theory and science of medicine and surgery, we are also making every effort to increase the practical work that the student will be a better doctor for the sick when "out on his own." This discussion is concerned chiefly with surgery, as this is where the student learns his "living pathology" and where it is necessary to make decisions quickly. The symptoms and physical signs may be studied leisurely at the bedside, but the judgment of what organ is pathological, the nature of the pathology, and the proper procedure in a surgical case must be decided in a matter of minutes. Therefore, the necessity for more and better opportunities to learn pathology in the operative clinic.

I am not forgetful of the fact that the interneship and residency is the great opportunity for the student, but the better we can prepare him for these positions, the more he will get out of his practical work. We, who have been out of school for a number of years, readily recognize in the recent graduate, his ability to describe accurately almost any of the pathological conditions, especially in the abdomen. He may even be able to make elaborate and accurate drawings of the change taking place and the deviation from the normal. Often, in my clinical work, which for several years has been teaching gynecology, I would be almost embarrassed by a new interne on the service, because of his accurate, detailed description of a concealed pathological condition in the abdomen. But what a difference, when the living pathology was encountered and exposed. All his accumulated knowledge seemed to leave him at once. As I have always stressed the value and importance of exploring the open abdomen, I will take as an illustration the gall bladder. Although my interne knew that in chronic gall-bladder disease the wall was thick and changed in color, adhesions were present, the adjacent liver was fibrosed, small stones were present, as well as most of the other signs, he was absolutely helpless to tell me whether the gall bladder was a normal or a pathological one. The same is true of the stomach and duodenum. Or in the pelvis, he could examine the patient in the outpatient department and state fairly accurately that a uterus or ovary was average size or altered, but when shown the actual living organ, he could not recognize even the common gross pathological changes. On analyzing the situation it seemed to me that the reason was that he had not seen enough living pathology during his laboratory and textbook study to recognize the living, gross pathology which he knew to exist.

The only opportunity the student has to educate his visual sense to living pathology

is in his attendance to the operating surgical clinic. And furthermore, the amount of visual education he obtains is dependent upon the operating surgeon's ability and desire to disseminate this knowledge with the facilities at hand. Many of our best surgeons and best teachers do not have the knack of talking while working, but that may be because of the lack of proper facilities to talk directly to the class while carrying out the surgical procedure. In visiting many of the large clinics of the country, it has always been noticeable to me, that the surgeon who would talk to his audience and describe the pathology, technique, etc. always had an attentive group of listeners. All of this prompted me to try and give the student group in the amphitheater, whether large or small, a better understanding of the why's and wherefore's of the work being done.

My early interest in, and some knowledge of radio, acquired by several years of study and experimenting, gave me the idea of using the amplifier and loud speaker to talk to the students while operating. Microphones, loud speakers and amplifiers were available, but how to make a practical application of the several units to the operating table presented somewhat of a problem.

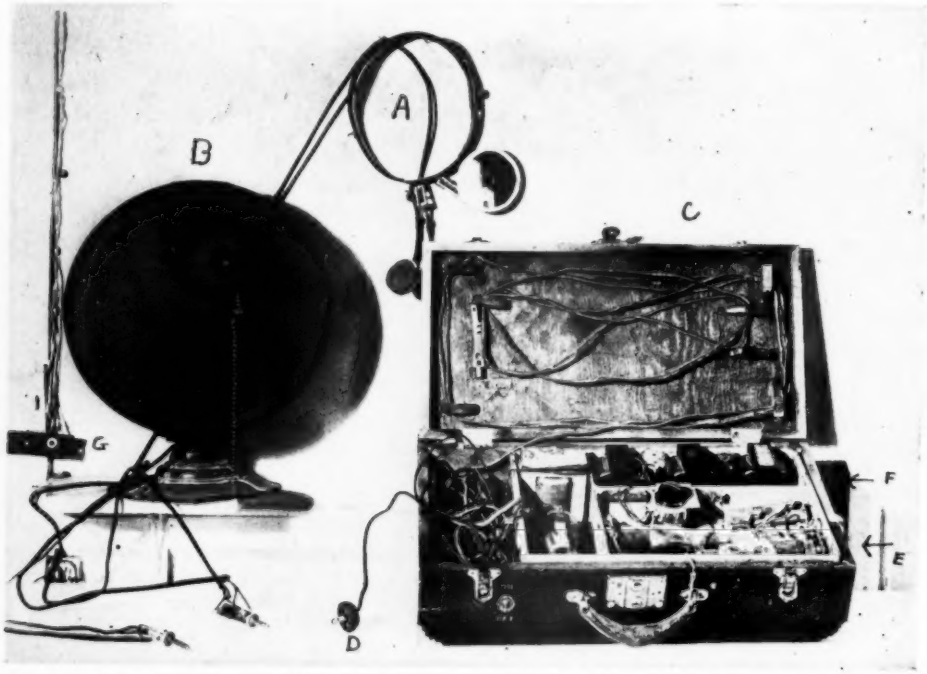

Fig. 1. A. Head band with microphone and head mirror attached. Plugs into "jack" at (*e*) by any convenient length of wire. For operating use, mirror is detached.

B. Standard type of speaker plugs into "jack" at (*f*).

C. Carrying case holding all parts except speaker. "Dial knob" in center for volume control.

(*d*) Insert into any 110-volt a.c. socket.

(*g*) "Jack" in office for microphone "input."

The amplifier shown here (Fig. 1, C) is a home-made one and very satisfactory, and with any good horn (Fig. 1, B), the voice is clear and distinct. In all public address systems in other uses than the operating room, it is a simple matter to place the microphone in the correct and convenient relation to the speaker, who does not materially change his position or direction of voice during the entire conversation. But how about the operating surgeon? His attention must not be taken from his work, so it was necessary for the microphone to follow the speaker. The accompanying

diagram shown here illustrates the solution (Figs. 1 A, 2 and 3).

The microphone must be small and light, not too sensitive, and be devoid of extraneous noises incident to moving and shaking. After trying out a great many in general use, I found one that is entirely satisfactory. As the illustration shows (Fig. 1, A) it is attached to a reflector head-band of any type that is comfortable to the head. A small rod passing down over the nose is entirely out of the field of vision and holds the microphone securely in position over the mouth, (Figs. 2 and 3). A fiber diaphragm is placed over the microphone, spaced about ⅛ inch to eliminate the rushing noise of the exhaled breath. The whole appliance is easily covered with an approved face mask and the operator is at once entirely unconscious of its presence (Fig. 3).

I have recently added a "cut out" device (not shown here) to enable the surgeon to disconnect the microphone from the horn if he does not wish parts of his conversation to be transmitted to the amphitheater. This is in the form of a belt worn under the gown and a wide, flat, brass spring "lever" occupying a position just under the left elbow at the side. A very slight pressure over this metal lever "cuts out" the microphone. I have used this the past two years and the students and others assure me that it adds very greatly to teaching and creates an added interest in the operative clinics.

Fig. 2. Use of microphone and head mirror in office.

Fig. 3. Microphone as worn in operating room. No obstruction to field of vision.

The operator may present the case, discuss the diagnosis, and outline the technique of the operation, even though separated from the amphitheater by the glass panel. Each step of the procedure can be clearly demonstrated and, most important, all normal and pathological conditions in the living can be shown and described in detail. I have had many internes assisting me, who for one and two years previously had sat in the amphitheater, assure me that they felt much more competent to recognize "what they saw," because of this improved teaching method. I have no hesitancy in strongly recommending the use of the public address system in teaching operating room surgery.

[Concluded on p. 496.]

RESTORATION OF FUNCTION OF HAND & ARM

FOLLOWING RADICAL AMPUTATION OF THE BREAST

CARL G. ROBERTS, M.D.

CHICAGO, ILL.

ONE of the principal postoperative problems connected with radical amputation of the breast for malignancy is that of restoration of function in movements of the affected arm. Removal of the pectoral muscles as outlined by Halsted many years ago, leaves a certain amount of incapacity which is oft-times slow in responding to the usual methods of treatment. This delays the return of the patient to occupational usefulness as well as proves inconvenient in ordinary personal hygienic routine.

The method of postoperative dressing of the wound and position of the arm have contributed in no little degree to the creation of this problem. It has been popularly accepted that the wide excision of tissue and muscle demanded close apposition of the arm to the chest in order to prevent undue tension upon the suture line with its attendant dangers. Improvements in the plastic modeling of the skin flaps have resulted in some modification of the original method however, and in recent years many cases are dressed with the arm in a position at right angles to the body, thus preventing the contracture in the healed scar that occurred with former close apposition of the arm to the chest. This has brought about some improvement both in hastening the return of the arm function and in degree of recovered usefulness. Even under these conditions the time usually required for a fair measure of usefulness of the affected arm varies from six weeks to six months. It has often required even a longer period before the arm could be elevated and the

FIGS. 1 AND 2. Case v. Eighth postoperative day.

hand placed on the back of the head. The inability to perform these essential motions has proved a source of great inconvenience and worry to numerous patients.

During the last ten years, a method has been used by the author which seems to be a solution of the problem of early restoration of function. After the patient has fully recovered from the affects of the anesthesia, the hand and forearm on the affected side are attached by adhesive plaster dressing to a traction apparatus such as is used with an ordinary fracture frame. The weight used averages from 2 to 4 pounds connected by rope through overhead pulleys which may be attached to a Balkan frame. The upper arm is at right angles to the body, the elbow flexed and the hand suspended upward with sufficient weight attached to prevent the elbow from touching the pillow or bed except by muscular effort on the part of the patient. The arm remains suspended by this apparatus continuously for the first three or four days, after which it may be disconnected at night and for a rest period of one to three hours during the day. Its use should be continued for about ten to twelve days after which it will no longer be necessary. After its discontinuation, the arm should be placed on a pillow at right angles to the body with the forearm and hand semiflexed.

The balancing of the weight and muscle tension provides the necessary passive motion while a certain amount of active motion within safe limits can be carried on by the patient with very little effort. This is conducive to early function, prevents contracture and provides an almost complete recovery of motion within the short period of hospital convalescence. The longest period required in any case treated by this method, for restoration of 80 to 90 per cent function, was four weeks. In a number of cases the patients were able to place their hands on the top or back of the head within four days after operation. All of them were able to perform this motion freely and without pain within a period of ten or twelve days.

Possible objections of undue tension on the wound carry little weight in the presence of the modern custom of thorough

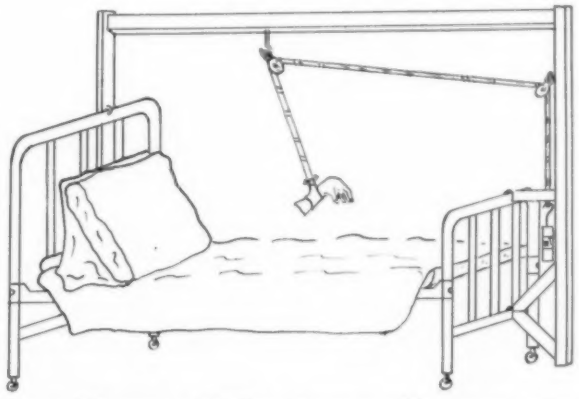

Fig. 3. Diagram of Balkan frame used in recent cases.

mobilization of the skin flaps and closure without undue primary tension. No instance of embolism has been noted. Slight fatigue may be experienced from continuous suspension of hand and arm, but it does not equal that present in the traction treatment of fractures because of the frequent change of position in the active and passive motion permitted by the weight and pulley system. While no originality is claimed for this particular method, a review of available literature has not revealed any published articles on its use.

The following are case reports illustrative of its efficacy:

Case I. Mrs. S. H. Operation October 1, 1923. Radical amputation of breast, both pectorals removed. Period of hospital convalescence, fourteen days. Recovery of function, 100 per cent, within three weeks.

Case II. Mrs. S. A. Operation May 5, 1925. Radical amputation of breast. Period of convalescence, sixteen days. Ninety per cent function within ten days.

Case III. Mrs. V. G. Operation October 31, 1925. Radical amputation of breast, both pectorals removed. Period of convalescence, three weeks. Eighty per cent function at end of hospital period.

Case IV. Mrs. L. G. Operation April 13, 1930. Radical amputation of breast, both pectorals removed. Period of convalescence,

twelve days. Seventy per cent function in eight days. Complete function within two weeks.

Case v.* Mrs. M. R. Operation May 5, 1931. Radical amputation of breast. Ninety per cent function in six days. Complete function in twelve days. (Figs. 1 and 2.)

These few cases are selected at random from a considerable number and are examples of results attained by this method of suspension which have thus far been uniform without exception.

The accompanying diagram (Fig. 3) illustrates the simplicity of the apparatus required and the principles upon which the treatment depends. The advantages in the early return to normal function greatly outweighs any disadvantages thus far discovered and it is submitted as an addition to the usual postoperative therapy calculated to hasten the full recovery to normal activity.

* Case v is presented through the courtesy and with the collaboration of Dr. W. W. Gibbs, Senior Gynecologist, Provident Hospital.

CONCLUSION OF DR. RAZUMOVSKY'S ARTICLE*

The method I am offering is very simple and safe and easily learned by any physician. We had not a single complication and not a single death in a hundred cases. With my five years' experience in this field, I have perfect assurance that alcoholization will replace many serious operations, such as radicotomy, ramisection, chordotomy and the like. Leriche's sympathectomy which may be followed by numerous complications such as breaking of blood vessels, thrombosis, etc., and even fatal issues, can well be replaced by alcoholization.

CONCLUSION OF DR. CHAFFIN'S ARTICLE†

I make no claim for originality for any part of the mechanism, but only for the practical application of the several units assembled.

Since using the system in the operating room, I have added it to my suite of offices to an advantage. My several rooms are wired with "input jacks," connected through the amplifier to a horn at the secretary's desk, and during busy hours it saves many minutes and steps in "one way" communication with the "desk."

For this purpose, I have a double post head-band (Figs. 1 A and 2), one post holding the reflecting mirror and the other the microphone.

A short wire and "plug," carried in the pocket, makes the contact convenient. When not using the microphone it is swung to one side, not too conspicuous and not in the least inconvenient.

* Continued from p. 490.
† Continued from p. 493.

THE MEDICOLEGAL IMPORTANCE OF THE PHYSICIAN'S & HOSPITAL RECORDS

SILAS A. LEWIS, M.D., F.A.C.S.

HOLLYWOOD, CALIF.

IN these days of unrest and turmoil, it is not surprising that the physicians and surgeons have been the target for malpractice actions of all descriptions. The shyster lawyer, the quack, the horde of sects, and the multitude of non-ethical M.D.'s, have seen their opportunity to put their hands in the pockets of many of our most serious, efficient and hard-working professional confreres. The first impression is that we should censure these vultures and commiserate with the prosecuted. When we make a study of the hospital records as kept by and under the supervision of the attending physician or surgeon one is not so sure that sympathy for the medical man is so well placed. I do not mean to suggest or intimate that the doctor keeping these records intentionally falsifies, but they are often grossly unkept or in error. Most forcibly is this brought to him on the witness stand. There is no more pitiable sight than the doctor caught in this embarrassing position.

It has been my privilege to serve on the Surgical Committee of one of our large hospitals in this city, where we meet one night each week to carefully review the surgical work of the previous seven days. In this hospital the charts are scrutinized by a most competent record librarian. They are examined for discrepancies or incomplete histories, for description of complete surgical examinations, for description of operation, observing whether they harmonize with postoperative diagnosis and pathological findings. In case there is any question this chart is sent to the Surgical Committee where it is carefully reviewed, not only on the points the librarian has indicated but the complete chart is gone over to see if there are other omissions, X-ray reports, laboratory reports, consultation write-ups, progress notes, etc. If there are gross discrepancies the surgeon is invited to meet with the Surgical Committee where he is told that in the review of his case record there are certain seeming errors and probably he can assist the Committee to straighten out the story of the case so his interests may be protected as well as those of the hospital.

In order that we may visualize certain of these cases I have prepared copies of recent charts in two hospitals. They probably demonstrate the usual types of errors and how lost the doctor would be in case the official record were placed in his hands on the witness stand as the only means of prompting his memory.

The following is a chart turned in by a most prominent surgeon of our town:

PHYSICAL EXAMINATION

CASE NO. 41196

NAME: Miss Jane Doe

WORKING DIAGNOSIS: AFTER PHYSICAL EXAMINATION: Convalescing from Acute Epidemic Poliomyelitis

PHYSICAL FINDINGS: Head, Neck, Chest, Cardio-Vascular, Abdomen, Genito-Urinary, Skin, Bones and Joints, Glandular, Neuro-Muscular:

See prev. xam.
(signed) Dr. Richard Roe

HISTORY—1

NAME: Miss Jane Doe

DOCTOR: Richard Roe

AGE: 44 SEX: Female

S.M.W.D. Race Occupation

DIAGNOSIS . . . Working
Final: Convalescing from Acute Epidemic Poliomyelitis
Complications

CAME FOR THE RELIEF OF

FAMILY HISTORY

PERSONAL HISTORY
See Previous History

PRESENT ILLNESS (signed)
ONSET AND HISTORY Dr. Richard Roe

SUBJECTIVE SYMPTOMS

On the face of it, this looks like sufficient data for a patient returning to the hospital, but when diligent search is made of the records after the woman had gone home it is embarrassing to find that this patient had never been in this hospital before and there is no possible way of obtaining a previous record without a great waste of the doctor's time.

The usual records in hospitals governed by the rules of the American College of Surgeons have a space for "Working Diagnosis After Physical Examination." This should correspond with the operation sheet which is headed: "Preoperative Diagnosis." On the personal history sheet are the words: "Final Diagnosis to be Recorded when Determined." That does not necessarily correspond with the postoperative diagnosis on the operation record but it should correspond with the pathological report if there was tissue examination. On the operation sheet under the heading of "Findings and Operation" which are either written or dictated immediately following the operation, we would expect to find the story correctly written while the picture is fresh in the surgeon's mind, but I submit the following example:

OPERATION RECORD (2)

Date: 11–5–1931

NAME: Jane Doe Room No. Doctor

PREOPERATIVE DIAGNOSIS
POSTOPERATIVE DIAGNOSIS: Exp. Lap. Release of Intra-abdominal adhesions.

FINDINGS (Including the condition of all organs examined): Firm abdominal wound adhesions of the omentum to the parietal peritoneum. Heavy bandlike adhesions of uterus to the bladder and to parietal peritoneum extending above the umbilicus. Varicoalis of the left broad ligament. Pelvic organs otherwise normal.

OPERATION (Including incision, Ligatures, Sutures, Drainage and Closure): Scar tissue was excised and dissection developed through the layers. The band-like adhesions were released by section, some oozing necessitating ligating in places. The omental adhesions were undisturbed. Closure described in full.

/s/ John Doe, M.D.
Surgeon

PATHOLOGICAL REPORT: An ovary, very markedly scarred and measuring $5 \times 3 \times 2$ cm. On each lateral surface is a small cystic space filled with organizing blood clot. On bisecting the ovary it shows lutean scars and marked fibrosis.

Signed by the Pathologist

In the surgeon's findings, including the condition of all organs examined, and in his operative procedure he makes no mention of a pathological ovary, nor of an oophorectomy, yet the Pathologist finds one and describes it in detail. The question that would arise in the minds of the jury would naturally be: did the doctor know he had removed this ovary at the time of operation and was its extirpation in the best interest of the patient's welfare?

If the stenographer from the Record Librarian's Department is not present at the completion of the operation the surgeon is prone to return the patient to her room, write or give verbal orders for postoperative care, and leave the hospital without a written record of what he has done, that is, his surgical procedure. It is the most natural thing when operating at night, the surgeon is extremely tired after the day's duties, to make this hasty escape, yet if there is necessity for calling him later and he cannot be located and another doctor is called in and does

not know what the operative procedure has been and the patient suffers in any measure from this doctor's inability to handle the case because of lack of data, the courts of California have held in several instances that the surgeon is guilty of malpractice and juries have bountifully reimbursed the sufferer out of the doctor's pocket.

The location of wounds in accident cases should be most minutely described, marked on diagrammatic body charts, with exact measurements, and also a careful description of the number of sutures or clips. In testifying for a patient who has a negligence action or a compensation case it is with a sense of great security that the doctor sits in the witness stand with notes made at the time of the service before him to prompt his memory. Not only is it a great sense of satisfaction to the doctor but it makes him a most valuable witness for his patient. In State Compensation cases where tetanus occurs not only does the Commission demand a description of the wound, but its exact location. The simple statement "contusion on finger" is not sufficient. The location on the finger and which finger must be stated.

Embarrassing situations may arise for the surgeon and be the basis of successful actions against him even when he has taken time to write a most beautiful description of his surgical procedure. I submit herewith the hospital case record of a patient operated upon on November 4, 1931, the history written by an interne:

Attacks of weakness and abdominal distress for past week. Shortness of breath. Tympanites.

About one month ago patient began having shortness of breath on slight exertion and even when quiet. She had distention of abdomen with gas associated with the dyspnea. Recently this condition has been improved.

One week ago patient developed a peculiar distress in lower abdomen that radiated lateralward and upward well up into thorax. States it felt like blood rushing up toward her neck. She became weak and rather dizzy but did not faint. No nausea or vomiting. Hands and feet became cold. Attack lasted about four hours. In two days she had another attack which was much shorter. Yesterday a slight attack occurred again.

We turn to the Physical Examination and find:

ABDOMEN: Marked tenderness over lower abdomen. No definite rigidity. No palpable masses.

Both of these sheets written by the interne are O.K.'d by the surgeon but nowhere do we find that a vaginal or rectal examination was made. We turn to the preoperative diagnosis; here it is with a complete copy of the operation record sheet:

OPERATION RECORD (2)

Date

NAME: Jane Doe Room No. Doctor

PREOPERATIVE DIAGNOSIS: Pelvic Pathology.

POSTOPERATIVE DIAGNOSIS: Retrocecal appendix. Retroversion and retroflexion of uterus.

FINDINGS (Including the condition of all organs examined): Appendectomy. Gilliam suspension. Sterilization. Right rectus incision. Uterus was in posterior position with fundus inclined toward right side. The appendix was retrocecal, but not adherent. Gall bladder was large, normal in size; it emptied on pressure. No stones palpable. The ovaries were small and the right quite fibrous. Appendectomy: Appendix was amputated, stumptied with No. 1 CG; mesoappendix ligated with No. 1 CG; Pagenstecher purse string suture with inversion of the stump after treating stump with carbolic and alcohol. The fundus of the uterus was pulled up in position and the round ligaments about 1½ inches from the cornu of the uterus on each side were brought through the peritoneum and fascia where they were later sutured with Pagenstecher. The Fallopian tubes were incised into the cornu of the uterus and the wound in the fundus was sutured with No. 1 plain CG and the proximal cut end of the tubes were tied. Peritoneum closed with No. 0 plain, doubled CG; fascia with No. 2 plain CG, doubled. Two figure of 8 B & B tension sutures were applied

through the skin and fascia and tied over rubber tubes at the site of and posterior to the wound. Skin closed with clips.

/s/ John Doe, M.D.
Surgeon

PATHOLOGICAL REPORT: Appendix measures 8½ by .4 cm. Serosa smooth wall is thin, mucosa apparently normal. Normal appendix.

Signed by the Pathologist

It will be hard for this doctor to convince a jury that he made a careful study of this woman's condition previous to operation. It will be still more difficult for him to explain why the "Fallopian tubes were incised into the cornu of the uterus and the fundus sutured," thus sterilizing a woman thirty-three years of age without signed permission of the patient, and her husband. In this instance even an amputated appendix is reported normal by the Pathologist.

A most interesting chart study recently came before our Committee. The record stated that the patient walked into the *X*-ray Department and that a picture showed a ureteral stone. *X*-ray report as follows:

Examination was made of the urinary tract of the above mentioned patient Dec. 4, 1931.

There is a faint shadow in the region of the pelvis of the left kidney. This is undoubtedly the calculus mentioned in previous examination.

He was immediately referred for an emergency operation, the surgeon writing the preoperative diagnosis of left ureteral stone. The patient, a man of twenty-one years, signing the permit for operation which states:

I, the undersigned, consent to the administration of whatever anesthetics and the performing of whatever operation may be decided to be necessary or advisable.

Signature

OPERATION RECORD

Case No. 45066

NAME Room No. Doctor

PREOPERATIVE DIAGNOSIS: Left ureteral stone.

POSTOPERATIVE DIAGNOSIS: Same.

FINDINGS (Including the condition of all organs examined): Left nephrectomy. Left lumbar incision. Kidney located with its superior tip opposite 10th rib. Kidney freed with difficulty and brought into the wound. Prolonged search for calculus instituted; could not be felt in kidney, pelvis, nor in ureter and in kidney pelvis. During manipulation upper end of ureter was lacerated. Hemorrhage was profuse. Hemorrhage necessitated a nephrectomy which was done.

OPERATION (Including Incision, Ligatures, Sutures, Drainage and Closure): Renal veins and renal arteries ligated with No. 3 20-day CG. Muscles closed with No. 1 plain; fascia closed with lock stitch of No. 2 chromic; fat closed with plain CG; skin with dermal. Penrose drain to kidney site.

/s/ John Doe, M.D.
Surgeon

PATHOLOGICAL REPORT: Specimen is a kidney measuring 11½ × 5 × 3½. Capsule slips easily, leaving smooth surface. It has been opened. Pelvis not enlarged. Section of kidney substance shows a fairly normal kidney tissue. Micro. section shows kidney tissue to be swollen, congested and there is a little round cell infiltration. After hemorrhages, but these are probably the result of traumatism in the operation.

Signed by the Pathologist

On the face of it, it would seem that this doctor had operated for a ureteral stone which on the *x*-ray appeared at the tip of the bougie in the region of the pelvis of the kidney at the entrance to the ureter. On the *x*-ray film it appeared as a faint shadow not larger than a sixteenth of an inch each way. The question that arose was: had this surgeon rushed a patient from *x*-ray to surgery as an emergency with no history written, nor other study of his case or attempt to dilate the ureter, gotten into desperate trouble and wound up with a nephrectomy, on a patient with a pathological report of a "normal kidney and no

stone found." The patient had recovered, left the hospital, and this incomplete record was all we had. May I ask what this surgeon's insurance carrier would say if this man brought action and there were no other available records? The functioning of our Committee was most beautiful in this instance. The surgeon was called in and presented office records and *x*-ray films which showed the study of this calculus with repeated cystoscopy, kidney examination and films. The only inexplicable thing to us being that he *x*-rayed him at all at the hospital; this he tried to clear by saying that the man was in such intense pain he wished to make an emergency of it and did not see how he was to do that without he demonstrated with the hospital picture the presence of a calculus. The technique in operative procedure with the loss of the kidney is still debatable as the proper procedure in the minds of this Committee after they had viewed the preoperative study which is now embodied in the chart.

It is most essential that the physician or surgeon sees to it that laboratory and *x*-ray reports are on the chart when it is turned in as complete. Within the past few weeks a surgeon in Los Angeles has been threatened with malpractice in the care of a patient injured in an automobile accident. There was a crushing lacerated wound of a finger. *X*-ray report shows no fracture yet after the patient had left the hospital, wounds all healed, and returned to the old family doctor, she still complained of this finger. *X*-ray films made by him showed a tiny fragment of bone fractured from the side of the middle phalanx of the index finger. The father of the girl immediately wished to establish a malpractice action for wrong care of the injured finger and although he has taken the daughter to several orthopedic surgeons in Los Angeles who tried to convince him that no disability has resulted from the care of the finger. It is a source of great satisfaction to the first doctor in attendance to have the report attached to the hospital records saying "there is no fracture of the finger."

Many of us are trying now to make our follow-up study of a fatality more complete. We are urging more autopsies. It is commonly understood by hospitals and undertakers that a permit for autopsy must be obtained from the next of kin but two illustrations will show how the doctor, hospital, or undertaker may be trapped. Within the last few days a man died in one of our hospitals; the doctor was extremely anxious for an autopsy. He telephoned the deceased's son who was the next of kin living, describing the necessity for an autopsy and asking for permission. The son readily granted it, agreeing to come to the hospital immediately and sign the necessary paper. The doctor informed the hospital that the son was on the way there to sign the paper. The Pathologist was notified and the autopsy performed at once. It was completed upon the arrival of the son, when to the amazement of all he revoked his telephonic permit and refused to sign any paper. The institution and the doctor are still on the anxious seat. Again quite recently a doctor appeared at an undertaking parlor to perform an autopsy on a patient he had attended. He stated to the undertaker that he had made a diligent search and that there were no known living relatives. The autopsy was performed but before the funeral a woman appeared with her attorney at the undertaking establishment demanding the body of her husband. The story unfolded was that the couple had not lived together for many years but had never been divorced. She had learned of her husband's death and appeared on the scene. She removed the body to another mortuary, started action against the undertaker and the physician for a large sum of money. Both the undertaker and the doctor were glad to settle before the action came to trial. For his share the undertaker paid the grieving widow $1200.00, and the doctor made a cash settlement, the amount of which I do not know. A most costly lesson to both of these men who were trying to perform a service!

DERMOID CYST OF THE OVARY

PERFORATING INTO THE URINARY BLADDER WITH PROFUSE HEMATURIA*

GEORGE H. EWELL, M.D.

MADISON, WIS.

DERMOIDS constitute about 10 per cent of all ovarian tumors, solid teratomas occur less frequently. They appear at all ages, most frequently between thirty and forty years. The malignant tumors occur rather earlier. Of all the pelvic dermoids, the ovarian dermoids are the ones that most frequently perforate the urinary bladder. The ovarian dermoids may migrate and become implanted on other structures or they may perforate other hollow viscera. Extensive calcification may take place.

FIG. 1. Arrows point to calcified areas in cyst wall. Ureteral catheter tip inside cyst cavity.

Rupture of the cyst may occur with the production of a low grade peritonitis, if the contents are sterile; or a purulent peritonitis if the contents are infected. Following rupture, multiple implantation cysts may develop, or the discharged contents may become encapsulated. Malignant changes develop in about 3 per cent of the dermoids, invasion of the peritoneum and surrounding organs usually follows.

Rupture into the bladder almost always follows infection of the cyst with subsequent suppuration. Germaine[1] states that when the opening between the cyst and bladder is large the cyst drains well and may be cured spontaneously. With a small opening, the infectious process in the cyst persists and the bladder becomes continually reinfected with recurrent attacks of cystitis.

Germaine collected reports of 25 cases and added one of his own and concluded that the cases may be divided into two classes: (1) those who came for a dermoid cyst in whom perforation of the urinary bladder had occurred as a complication, and (2) those who came with symptoms of cystitis and examination showed that the cystitis was due to perforation of the bladder by a dermoid cyst.

DIAGNOSIS AND TREATMENT

There is nothing suggestive about the history except the passage of hair and other detritus common to dermoids from the urinary bladder during or following an attack of cystitis. Such symptoms together with cystoscopic and *x*-ray findings and pelvic examination warrant a clinical diagnosis.

When possible, extirpation of the cyst with resection of the involved wall of the bladder is the logical treatment. Cystotomy with curettage of the cyst and

* Read before The Wisconsin Urological Society, Iowa City, Iowa, April 23, 1932.

drainage has been done as a palliative measure.

One of the earliest reported cases is that of Ruge[2] in 1846. A woman aged forty-six was operated on for vesical calculus; none was found. An orifice led into a cavity that could not be explored with the finger, the patient died. Autopsy disclosed a cyst of the left ovary with a sinus tract opening into the bladder. There was a similiar cyst of the right ovary.

In the case reported by Larrey,[3] the cyst not only opened into the bladder but also perforated the anterior abdominal wall. Sentins'[4] patient had two vesical calculi, one of which contained a tooth. Marshall's[5] patient passed many calculi and pieces of bone; autopsy showed both ovaries united into one large tumor. In Greenhalge's[6] case, labor was arrested on account of a pelvic tumor mass, hair and pus were passed per urethra. There was an umbilical fistula that discharged pus and urine. Autopsy showed a cyst of the right ovary containing hair and bone; it communicated with the umbilicus, bladder, rectum and peritoneum.

In Tillaux's[7] case the cyst contained 12 liters of fluid and had been tapped several times. The patient stated that the cyst would disappear spontaneously on emptying the bladder. Blackman's[8] patient expelled hair through the urethra; several calculi containing teeth were removed. There was also leakage of urine through the rectum. Germaine's patient had several attacks of severe hematuria, together with severe cystitis. Operation disclosed a dermoid cyst of the left ovary. Thomas and Exley's patient had openings into the urinary bladder, sigmoid and ileum with an appendiceal abscess. In Barnsby's case the cecum and appendix were also involved.

Fig. 2. Cyst mass and tube.

Fig. 3. Arrow points to calcified area.

CASE REPORT

Mrs. H. H., aged sixty-five, came to the Jackson Clinic in October, 1931, complaining of hematuria, dysuria and frequency. There were bright blood and clots in the urine. The hematuria had been present for three days and was profuse. Further history was irrelevant.

Past Medical History: Measles at fourteen, pneumonia at fifteen, typhoid at twenty-one. Menses began at fourteen, normal. Thirty-three years ago, six months following confinement, there was frequency, dysuria with obstruction to passage of urine. A mass of hair ½-inch thick and 3 inches long was removed from the

urethra. Three years later, a stone was removed from the bladder per urethra. During pregnancy there had been considerable bladder distress. During the following years there were attacks of frequency, dysuria and nocturia. Fourteen years ago there was an attack of hematuria that lasted several days and again two years ago.

Physical Examination: Well-developed, fairly well-nourished adult female, weight 150 pounds. Pulse 85. Temperature 99°F. Blood pressure 150/95. Head, neck, lungs and heart negative. Abdomen negative, except for tenderness over the lower quadrants. Extremities normal. Pelvic examination. Cervix and uterus normal in size; on the left there was an indefinite mass deep in the pelvis that was tender on palpation.

Laboratory Findings: W. B. C. 11,900, hemoglobin 80 per cent, R. B. C. 4,850,000. Urine neutral, specific gravity 1.002, albumin 1, sugar negative, blood graded 4 and pus graded 4. *X*-ray of pelvis shows a calcific mass 3 × 4 cm. in mid pelvis, at brim (Fig. 1). The cystogram shows a small filling defect on the posterior left side.

Cystoscopy: Bladder filled with clots and debris. Diffuse cystitis, graded 4. Both ureters easily catheterized and the specimens showed numerous pus cells. Indigocarmine appeared in six minutes on both sides and in good concentration. On the posterior wall, an opening 1 × 1 cm. could be seen into which a ureteral catheter would pass for a short distance; through the opening blood was seen to come with other debris.

Diagnosis: 1. Bilateral pyelitis. Cystitis. 2. Vesicopelvic fistula, probably an ovarian dermoid with rupture into the urinary bladder.

Operation: October 26, 1931. Laparotomy by Doctor Reginald H. Jackson. A mass in the region of the left ovary with attachment to the posterior bladder wall was found (Fig. 2). The mass and tube were removed and the involved wall of the bladder resected. The right ovary and tube were normal, as were the other pelvic structures. Closure was made with pelvic drainage and bladder drainage by means of inlying catheter. After several days there was leakage of urine from the suprapubic wound. The sinus opened and drained urine on several occasions during the hospital stay. At the time of discharge, there had not been leakage for several days. On the forty-first postoperative day, there was a temperature to 103°F.; the day following a chill with temperature to 104°F. with tenderness in both costovertebral angles. Cystoscopy was done with lavage of both renal pelves. The temperature for the next few days did not go above 100.5°F., but the tenderness over the right costovertebral angle persisted. Cystoscopy was again done with lavage of the right renal pelvis. Following this treatment the temperature did not go above 99.5°F. The patient was discharged on the fifty-third postoperative day, with temperature normal and greatly improved in general health.

The gross specimen contained a large calcified area that can readily be seen on the accompanying photograph (Fig. 3).

Pathological Report (Dr. C. H. Bunting, University of Wisconsin): The main cystic cavity is evidently one of a chronic abscess and has a dense fibrous wall with calcification (and probably bone) and is lined with granulation tissue, heavily infiltrated with lymphocytes and plasma cells. In only one part of the wall have I found a small area of the character of ovarian stroma. I can find nowhere the outer germ layer, stratified epithelium hair follicles and sebaceous glands, characteristic of the usual ovarian dermoid. One portion of the cavity, however, has a lining quite typical of the colon mucosa, with muscularis and submucosa. In the submucosa are areas of mucous gland, suggestive of submaxillary gland; and an alveolus lined by epithelium of the respiratory type, all inner germ layer structures usually not present in any quantity in ovarian dermoids, still quite often represented. I would suggest rather than a malignant change that the patient has an infected dermoid, which ulcerated into the bladder, discharging the material mentioned and that we have left a chronic inflammatory condition and the more solid part of the teratomatous structure. I have not found anything I would call malignancy with certainty.

COMMENT

Hematuria may result from lesions outside of the urinary tract as well as lesions in the urinary tract.

Perforation of the urinary bladder by lesions in adjacent organs is usually a complication of a serious nature.

[For References see p. 508.]

SUPRAPUBIC CYSTOTOMY

AND THE PREVENTION OF PELVIC CELLULITIS*

LEWIS T. MANN, M.D.

NEW YORK CITY

VARIOUS authors have contributed to modern literature articles dealing with this subject, pointing to pelvic cellulitis as an outstanding cause of death. With this in mind, the records at Mount Sinai Hospital from 1914 to the present were reviewed. The cases considered were operated upon by all surgeons on all surgical services, and the technique was practically the same, offering a broad basis of judgment.

Before proceeding with our data, perhaps a review of contributions to modern literature, starting with the paper of Williams[1] who did what he calls a two-stage cystotomy in 1916, will give us an interesting background. He first incised down to the bladder, packing the space of Retzius with gauze, and 4 to 7 days later entered the bladder. Neff[2] found that 20 per cent of one-stage prostatectomies and one-stage cystotomies were infected, with more or less fascial sloughing. Adopting Williams' technique resulted for him in but one death in 38 cases over a period of thirty-two months. The cause of death in this case was not given.

Keyes[3] states in an article that pelvic cellulitis is the most dangerous complication to suprapubic bladder operations. He estimates the mortality from suprapubic cystotomy preliminary to prostatectomy to be 10 per cent. There were 33 deaths in 102 preliminary cystotomies from 1917 to 1922 at Bellevue, and pelvic cellulitis was the predominant cause; but no case reports or autopsy findings are given. His observations led him to adopt the three-stage operation, in which he essentially follows the technique of Williams. In a group of 29 suprapubic prostatectomies performed by this method, there was no fatality. In a parallel series of one-stage cystotomies, there were 2 deaths. In his opinion, many deaths in the past attributed to poor renal function were in fact due to pelvic cellulitis.

Keyes[4] in a subsequent paper gives the following figures showing the relatively good effect of prevesical section: 278 prostatic patients entered the hospital; 14 per cent were not operated upon; 15 per cent died of the disease or treatment; 71 per cent survived operation. The prostatectomy mortality rate was 10 per cent.

Out of this group Keyes drained in only 9 cases, with 7 deaths. He did 41 one-stage prostatectomies, with 5 deaths; and 113 two-stage operations, with 7 deaths. The 9 drain cases and 113 two-stage prostatectomies included 33 prevesical sections. He states that the prevesical procedure is preferable in suprapubic lithotomy for large phosphatic stones, but for prostatics the clean preliminary cystotomy seems the operation of choice.

Vermooten[5] refers to these papers, accepting the conclusion that perivesical infection is the cause of high mortality following suprapubic cystotomy. The majority of his prostatectomies were done by the perineal method, and suprapubic cystotomy only performed when catheter drainage was unsuccessful or for procedures on the bladder itself. There was a 30 per cent death rate in 77 suprapubic cystotomies. Twenty-three were preliminary to prostatectomy, with 2 deaths. Eighteen deaths followed 42 cystotomies for bladder drainage, and 3 cases out of a series of 12 for various bladder conditions terminated fatally. Therefore there were 21 deaths in 54 cases where no prostatectomy was done.

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Nine ran a septic course; only 1 showed perivesical suppuration at autopsy, and the rest died of pneumonia, uremia, etc. There was no pelvic cellulitis in the two prostate deaths.

Vermooten used the Kidd perforator in his new technique, and in a series of 6 cases for relief of retention, got primary union. One patient died, but the wound was clean. After exposing the bladder, he introduces a Malecot catheter through the perforator, sews the bladder about the catheter, and drains the space of Retzius with a rubber dam. The tube, according to his illustrations, is brought out at any level—upper angle, middle of the wound, or lower angle.

He has but one case in his series to substantiate his contention that perivesical cellulitis is responsible for a large percentage of deaths following suprapubic cystotomy.

Lowsley and Kirwin[6] bring the tube out at the upper angle of the wound and drain with a small cigaret drain along the vesical suture line. They enter the bladder at the highest point of the fundus, also using the Kidd perforator and Malecot catheter.

Our results at Mount Sinai Hospital from 1914 to date are shown in Tables I and II.

The autopsy reports in the cases of perivesical suppuration follow:

(1) Male sixty-six years old. Died August 16, 1922, after one-stage prostatectomy. Findings: Gangrenous cystitis; osteomyelitis of the symphysis pubis; infection of space of Retzius.

(2) Male sixty-three years old. Died in March, 1927, after suprapubic cystotomy for bladder tumor. Findings: Suppuration in the space of Retzius; cellulitis of the tissues about the pubis; severe cystitis.

(3) Male seventy-seven years old. Died in October, 1929, Left abdominal ureterolithotomy and suprapubic cystotomy. Findings: Gangrenous cystitis and phlegmon of pericystitic tissues.

(4) Male. Two-stage prostatectomy. Patient had hemorrhage three times after removal of packings and re-packing. Died in uremia. Findings: Laceration of bladder neck and acute cystitis and pericystitis.

TABLE I

	Number of Cases	Deaths	Mortality Percentage	Autopsies
Total cystotomies	729	81	11	50
Cystotomies for prostatic adenoma	58	21	36	16
One-stage prostatectomies	77	7	10 } 7.4	5
Two-stage prostatectomies	513	37	7.2 }	19
Total operations for prostatic adenoma	648	65	10	40
Cystotomies for other conditions	81	16	20	10

Analysis: 62 per cent of the fatal cases were autopsied. Simple cystotomy for prostatic adenoma, with a 36 per cent mortality, was done for acute urinary retention, many being in desperate condition (in cardiac collapse, uremia, etc.).

TABLE II

CAUSE OF DEATH IN 50 AUTOPSIED CASES

	Cystotomy for Prostatic Adenoma	For Other Conditions	One-stage Prostatectomy	Two-stage Prostatectomy
Perivesical suppuration	1	1	1	1
Cardiac deaths	5	4	1	3
Uremia	4	1	..	3
Pneumonia	3	1	2	3
Renal infection	2	1	..	3
Sepsis	1	..	..	3
Embolism	..	1		
Carcinomatosis	..	1		
Meningitis	..	..	1	1
Hemorrhage	..	..	..	2
Totals	16	10	5	19

Our experiences at Mount Sinai Hospital therefore fail to support the high mortality credited to perivesical suppuration incident to suprapubic cystotomy. In the foregoing tabulation of 50 autopsied cases we see that of 81 deaths out of 729 suprapubic cystotomies for all conditions only 4 were due to perivesical suppuration. We therefore believe that the technique of operation is a primary consideration in preventing infection of the space of Retzius and its further spread to produce pelvic cellulitis. No

matter what care is exercised, it is practically impossible to avoid contaminating the suprapubic wound when the urine is infected. It is therefore important to establish free and adequate drainage of the wound.

The technique advocated is: The bladder is irrigated, and 2 ounces of 2 per cent novocaine left in. Using a 1 per cent novocaine anesthesia, the skin and fascia are divided to the perivesical fat. The bladder is then distended with water, and the peritoneum pushed up, if necessary. The bladder is freed of perivesical fat for an inch or so in the line of incision, then infiltrated with novocaine, seized with Allis clamps, and the viscus incised. The field is cleared of fluid by aspiration, and the bladder painlessly explored with the finger. A Pezzer catheter or large tube is introduced into the bladder, and the latter sutured with one stitch above the tube. The bladder is next attached to the fascia on either side with a suture. The fascia is sutured above the tube, and a strip of iodoform gauze is inserted above and below it. No sutures are placed below the tube, leaving space for good and free drainage. The skin is closed with a few sutures, and the tube and gauze drains brought out at the lower angle of the wound.

We have had good results and little suppuration by avoiding opening the space of Retzius unduly, by bringing the tube out at the lower angle of the wound, and by not suturing the fascia tightly below the tube and so shutting off drainage.

After enucleation of the prostate, there is further danger of pelvic suppuration from packing the prostatic bed too tightly. We pack lightly with thromboplastin gauze, and remove this on the fourth day.

CONCLUSIONS

Eight per cent of autopsied cases in our series died of perivesical suppuration, which is not in keeping with the opinions of other authors that this is the main cause of death in suprapubic cystotomy. Twenty-four autopsies were on prostatectomized cases. Two died of pelvic cellulitis, which is 8.3 per cent of the autopsied, or 0.3 per cent of all prostatectomies. Of 16 deaths after simple cystotomy for relief of prostatic obstruction, in which autopsy was done, one died of perivesical suppuration (6.2 per cent).

Finally, of those who died after suprapubic cystotomy for conditions other than prostatic adenoma, autopsy showed 1 in 10 deaths were due to pelvic cellulitis, a 10 per cent rate.

Therefore, in performing suprapubic cystotomy with our technique, which establishes adequate drainage of the space of Retzius and the wound, perivesical suppuration can be prevented and is not and should not be the predominant dangerous complication and the prime cause of death.

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DISCUSSION

Dr. Edwin Beer: Dr. Mann's excellent report definitely proves that if proper drainage is instituted in the course of suprapubic cystotomies, whether done as a first stage or a one step prostatectomy, there is a very low mortality due to perivesical suppuration. In this extensive series of cases which Dr. Mann has reviewed, he found only 8 per cent of the deaths caused by such perivesical suppuration.

According to recent literature, one would obtain a totally different picture concerning the incidence of such suppuration, and the recommendation made that three stage opera-

tion be done, based on the feeling that perivesical suppuration is a common cause of death, falls to the ground. If the second stage of a prostatectomy is done too early, that is, before a week has elapsed, as some authors have recommended, one is liable to re-open the perivesical tissues despite adequate drainage at the first stage and re-infect the tissues which have been separated prematurely.

The question of perivesical infection, strange to say, has been discussed for years, and already in Nelaton's book on surgery, published in 1884, he calls attention to the advisability of a two-stage operation, the dissection being done down to the bladder, and at a later date opening the bladder. It was this surgeon to whom I referred recently in connection with the Guyon celebration and the French defeat at the battle of Sedan.

According to many of the illustrations in recent literature in which perivesical infection has been emphasized as a common cause of death, it is noticeable that the surgeon does not adequately drain the lower part of his abdominal incision, bringing out the tube in the middle or upper part of the incision and closing the lower part of the abdominal wall. Leakage along the tube, of infected urine, naturally will gravitate to the pelvis and infect the perivesical tissues, and it is much safer to bring the tube out at the lower angle, and suture the upper part of the wound, making adequate drainage alongside of the tube with gauze. This technique of bringing the tube out above might be in part due to the fallacious teaching which recommends draining through the fundus of the bladder, rather than the anterior wall. If one exposes the fundus and places the tube in the bladder at its highest point, naturally one might be more or less forced to bring out the drainage tube above the lower angle of the wound, and if one does that, one invites infection of the perivesical space.

I believe Dr. Mann's statistics show conclusively that suprapubic cystotomy should not be followed by perivesical suppuration in a large percentage of cases, in other words, perivesical infection is a negligible factor.

Dr. George Winthrop Fish: I might add to the unpublished statistics that in the last 776 cases of suprapubic cystotomy done at the Squier Clinic there have been but 2 deaths attributed to perivesical infection; in one of these sepsis occurred ten days after operation, and in the other two weeks after. One of them was proved at autopsy, the other was questionable. This helps to substantiate Dr. Mann's statement that perivesical infection following suprapubic cystotomy as a mortality factor is rather negligible.

Dr. Irving Simons: I wish to state that I am entirely in accord with Dr. Mann. In a good many years of prostatic operating I have never yet seen active suppuration in the perivascular space that caused any alarming symptoms. Probably this is due to the fortunate fact that I have drained sufficiently and have not tried to close up as well as some have advocated.

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* Continued from p. 504.

TECHNIQUE OF

BARTHOLIN CYST EXCISION FOLLOWING PARAFFIN INJECTION*

LIONEL S. AUSTER, M.D.

NEW YORK CITY

THE apparently simple procedure of excising Bartholin gland cysts is usually followed by a protracted postoperative course, complicated by infections, draining sinuses and recurrences.

In acute purulent inflammation with abscess formation in the labium following an infection (usually gonococcal) of the Bartholin gland, the area is incised and drained. If this is performed properly, with the incision placed lateral to the mucocutaneous junction, the pus is readily evacuated and the acute inflammatory condition subsides with eventual healing. If the abscess is permitted to rupture spontaneously, as is often the case in patients who hesitate to seek professional aid, the rupture takes place on the inner surface of the labium, impeding adequate drainage and usually causing a protracted convalescence. In any event, the subsequent course of this lesion, in the majority of cases, is the production of a cystic tumor, which, though sterile, does not subside and gradually enlarges in size. The small cyst may become reinfected, either by a specific organism or the usual pyogenic bacteria, as a result of traumatic irritation in this region, thus producing another abscess. If no further infection supervenes, the sterile cyst may enlarge and give intermittent or continuous symptoms by its presence. Visual and digital examination of these lesions never gives a true picture of the actual size of the cyst. Externally, they usually seem to be no larger than the size of a large pea or navy bean, which fact frequently induces the doctor to attempt excision as an office procedure. Actually, the extent of the cyst is up to 5 cm. in its long diameter, with invasion and protrusion into the soft, deep areolar tissue. The cyst wall is invariably thin and friable and, even under the best conditions of exposure and operating room assistance, it is almost impossible to remove these deep-lying masses without breaking the wall. Once the thin cyst wall is broken and the fluid or semi-fluid content exuded, the problem of removing all parts of the tissue is greatly intensified. In the midst of bleeding, it is almost impossible to completely remove the deeper portions of the cyst which are densely adherent to the surrounding tissue and, in a state of collapse, are extremely difficult if not impossible of identification. The fact that a small amount of tissue is left behind is sufficient to produce recurrence in most cases, and the occasional draining sinuses which persist for months following such an attempt at removal are most annoying, both to surgeon and patient.

In an attempt to provide a technique whereby the cyst could be filled with solid material to maintain its shape and outline, it was necessary to find a substance which would be hard at body temperature, which could be easily sterilized, which would be non-irritating and which could be injected into the cavity simply and without danger. It was found that the paraffin used for embedding tissues in the pathological laboratory (melting point about 50°C.) fulfilled these postulates, and the following technique was elaborated and has been used successfully in seven cases:

(1) Preliminary preparation of the paraffin is necessary before operation. Take one large, flat piece of paraffin, such as is used for tissue embedding or the sealing of preserving jars (parowax or

* From the Department of Surgery, the Bronx Hospital, New York, N. Y.

gulf-wax are two satisfactory available commercial brands). Cut the solid paraffin into small pieces and place them into a glass beaker, tumbler or jar. Melt it in a water bath or sterilizer. The melted wax should be placed in a wide-mouthed bottle, jar or flask, which may be sterilized by repeated boilings or in the autoclave. It is re-sterilized before use in the operating room, the rubber stopper of the jar or flask being covered with gauze.

(2) The operating room set-up includes a basin to contain hot water in which are placed the flask of hot, melted paraffin, two 16 or 18 gauge needles and two Luer syringes of 10 c.c. capacity, all of which have been sterilized with the instruments.

(3) The patient is prepared in the lithotomy position and, after the soap scrub, the vulva is dried and painted with picric acid. A needle attached to the first aspirating syringe is plunged through the skin into the cyst and the fluid contained therein is withdrawn. While the needle is held rigidly in position by the nurse or assistant, the aspirating syringe is removed with the fluid. The melted paraffin is then quickly poured into the second hot syringe, which is then attached to the needle and the paraffin is slowly injected into the cyst cavity, with gentle pressure. The cyst will again distend and when the resistance has increased to a point where adequate distention is obtained, the needle is permitted to remain in position for about a minute, after which time it is withdrawn. A small thread of paraffin will usually be seen to follow out through the needle track. This may be wiped away. By the time the linear incision through the outer margin of the labium is completed, the paraffin will have hardened sufficiently to provide a solid tumor before the operator's eyes, which may then be enucleated with ease and rapidity.

(4) There are two ligatures which should be passed before removing the filled cyst. One should be placed about the distal end of the duct, which may be identified as a thin strand running medially toward the vaginal orifice. The other ligature is passed about the deep attachment of the gland, and will take care of most of the hemorrhage.

(5) In cysts of comparatively large size, there is a large empty space left in loose areolar tissue. This space is best obliterated by one or two fine, plain catgut sutures which approximate the walls of the cavity. Complete hemostasis will prevent the formation of a large hematoma. A moderate amount of tissue exudation and bleeding, with subsequent induration, is unavoidable. The skin wound is carefully approximated with fine, interrupted silk sutures, without drainage. The moderate amount of induration which follows is usually completely resorbed within ten days. Careful perineal hygiene should be instituted with painting of the suture line with a bland antiseptic, such as 2 per cent mercurochrome. It is advisable to keep these patients in bed for at least three days.

This method of cyst excision may be used in almost any location where there is a small cyst containing fluid material. It is difficult, however, to handle sebaceous cysts with this technique on account of the fact that the cyst contents do not lend themselves to easy aspiration.

THE USE OF

BACTERIAL FILTRATES (ANTIVIRUS) IN GENITOURINARY INFECTION*

LOUIS NERB, PH.D.

BROOKLYN, N. Y.

IN French and German literature and also that of this country, one finds a great many versions of Besredka's so-called antivirus treatment. (1) The name "antivirus" is a misleading one, since we are not dealing with a live or growing organism, but rather with the toxins of individual bacteria. Antivirus is an extract of the bacterial body which contains most of the soluble exotoxin and some of the endotoxin; therefore, the name "bacterial antigen" or simple "bacterial filtrate" is a more proper one.

Besredka has done a great deal of work with the bacterial filtrates in the field of urology, and although there has been considerable interest, the results have been varied. He claims that the filtrate of bacteria, grown in broth till they are attenuated or killed, produces a specific immunity when injected intradermally into patients infected with the same strain of organism. This statement is greatly disputed by several prominent authorities. Frederick P. Gay,[2] in his article "Tissue Resistance and Immunity" says:

> Besredka speaks about the extraordinary results seen in the treatment of both local and general infections by the application or injection of filtrates from broth cultures of the organism concerned. Irrespective of any practical usefulness of this method in therapy, I believe there can no longer be any doubt that the effect produced is a non-specific one. Besredka's so-called desensitizing effect is simply an enhancement of natural resistance through clasmatocyte stimulation.

Despite this statement, there is no doubt that by local application of the bacterial filtrates some startling clinical results have been obtained, especially if followed by intradermal injections. The skin plays an important part in producing immunity, due to the fact that the reticulo-endothelial system is stimulated. The skin is composed of two very distinct parts, considered from the embryological as well as the histological point of view, i.e. the epidermis, which is derived from the ectoblastic layer, and the derma or cutis vera, which is derived from the mesoblastic layer. The derma or cutis vera is composed of a network of elastic fibers of great strength interlaced with connective tissue elements. The rich vascularity of this area makes it possible to bring large quantities of blood into the skin, and at the same time the histocytes of the loose connective tissue act as receptive cells, capable of being stimulated to participate in the body's defensive mechanism against infection.[3]

The laboratory technique of preparing the filtrate, especially in the coli infection, is a rather simple one. The pus or urine received is cultured in dextrose broth and transplanted on Conradi-Drigalsky media or purple agar. Young colonies are carefully picked and transplanted into dextrose, maltose, lactose and saccharose media fermentation tubes. This is done for our own information to verify the strain of B. coli. It is then transplanted again into large Erlenmeyer flasks of ordinary dextrose broth media containing from 100 to 150 c.c. The filtrate from these flasks is used for local application into the bladder, etc. but should not be used for intradermal injection, since it contains products from the katabolic activities of the colon bacillus.

* Read before the N. Y. Academy of Medicine, Section on Genito-Urinary Surgery, March 16, 1932.

For intradermal use we are using Asparagine-potassium phosphate media, to avoid as much as possible severe skin reactions which may be seen if broth filtrate containing peptone is used.

The broth is recultured after one week and then every three days to ascertain if the bacteria are still alive. The time required for the preparation is from twelve to nineteen days. The broth is then centrifuged under high speed for twenty minutes to throw down impurities and the bacterial bodies, then run through a Berkefeld candle N3 to insure sterility and filled into small sterile bottles. The finished product is recultured to make sure that there is no outside contamination. This is also done anaerobically for sporebearers. The reculturing is rather essential, since it is a fact that the broth is still a good and even a better media for other bacteria especially for streptococci. The method of planting B. coli into broth, killing them by heat and filtration and then using the broth for culturing streptococci, is often used in bacteriological laboratories, to obtain sugar free broth.

Besredka mentions in his book that the finished product can be sterilized by heat at 100° c. but we refrain from doing so, since apparently the filtrate depends largely upon the presence of the toxins and it is a well-known fact that most of the soluble toxins are not thermostable and may be destroyed by heat.

Staphylococcus and streptococcus filtrates are prepared in the same way, except that the sugar media are not used. Heat sterilization is definitely to be avoided. The preparation of gonococcus filtrates is a much more difficult one, since the growth of the gonococcus depends entirely upon the addition of protein body fluids as ascitic or hydrocele fluid rich in protein.

The pus is planted upon Torrey's agar media, fresh colonies fished and planted on gonococcus diagnostic fermentation media. This consists of sugar-free meat infusion with a bromthymol blue indicator. Within twenty-four to forty-eight hours gonococcus colonies change from bluish green to yellow. These colonies are transferred again to asparagine phosphate media enough asicitic or hydrocele fluid being added to make it a 10 per cent solution. After one week the media is recultured on Torrey's agar media to find out if growth is still going on. It is our experience that within twelve days growth has ceased. It is then centrifuged the same as the other filtrates, the supernatant fluid decanted into an Erlenmeyer flask and put on the waterbath at about 70° c. to coagulate the excessive protein, and again centrifuged under high speed to throw down the precipitated protein and filtered through a Berkefeld N3 candle. The finished product is then again tested for sterility and put up in small ampoules, ready for intradermal injection. Just as a matter of interest the quantitative protein was determined and we found that it varies between 20 and 25 mg. of total protein per 100 c.c. of filtrate.

TECHNIQUE OF INTRADERMAL INJECTION

For the injections, it is essential to have a well-fitting 1 c.c. syringe graduated in twentieths of a cubic centimeter, using either a Luer or tuberculin syringe and ¾ inch, 25 gauge needle. A good syringe is very important since the injections are made into the skin and the filtrate injected under considerable pressure because the displacement of the tissue is much harder than subcutaneously where the fluid diffuses out easily into the tissue. The upper arm is usually chosen for injection except in women where it is given in the thigh, since the marks of the injection are sometimes visible for a week and even longer.

The injection is made by holding the needle parallel to the skin surface. With the oval-shaped point visible, it is inserted slowly into the papillary layer and the solution is slowly injected. If the injection is given correctly, a non-translucent wheal, white in color, is produced, circumscribed with a pinkish border. It is practically the

same process as in the Schick test, where the needle and especially the point are visible through the skin. If larger quantities, i.e. 0.5 to 1 c.c., are given the needle is inserted full length and during the injection slowly withdrawn.

ARTHUS' PHENOMENON

Opie[4] points out the danger of giving the injections too close to each other since the area of the puncture becomes rather indurated and produces local necrosis. He believes that "anaphylactic inflammation occurs because antigen and antibodies have met in the tissue." This is commonly known as "Arthus' phenomenon." For this reason it is advisable to change the area of injection from one arm or leg to the other. If repeated injections are made in the same extremities, they should be made at least 4 to 5 inches apart.

DOSAGE

It is our practice to start with a small dosage, that is 0.1 c.c. and increasing 0.1 c.c. each time, until 1 c.c. is given. It is better to give the injection every forty-eight hours and keep the dosage smaller, not exceeding 0.5 c.c. if a large local reaction occurs. Smaller doses may be given or the filtrate diluted 20 times.

COLON INFECTIONS

We cannot report the results of colon infections treated this way, because these cases have not yet been summarized. We may say, however, that we have had considerable success in these cases and that our results warrant further study and investigation.

GONOCOCCUS INFECTIONS

In gonococcus infections, the treatment with the bacterial filtrates has, so far, been unsuccessful but we are able to report 100 per cent specific reactions in cases where there was an acute or chronic infection. We ran many control cases with a negative history, which showed no reaction, although quantities of 0.5 c.c. had been injected.

We are using the bacterial filtrate treatment a great deal in other branches of medicine as in gastroenterology and in the treatment of arthritis. In cases of infection of the lower bowels, the autogenous bacterial filtrate is applied directly to the ulcerated areas and in addition, intradermal injections are given, with very promising results.

In infectious arthritis, cultures are taken from the usual foci of infection: the throat, gums, nose, teeth and feces of the patients. The streptococci are isolated, bacterial filtrates prepared and injected intradermally with fair success.

At present we are experimenting by adding chemically killed fresh bacteria to the autogenous bacterial filtrates, thereby increasing the specificity by adding the soluble toxins. Our contention is that we shall get more rapid results.

CONCLUSIONS

1. Besredka's bacterial filtrates, even if not specific, will increase natural resistance by stimulating the reticulo-endothelial system.

2. An autogenous filtrate is to be preferred, but stock filtrates can be used while the other is in preparation.

3. It is essential, if stock filtrates are given, to define accurately the specific strain of the organism which causes the infection.

4. Bacterial filtrates have proved of value in gastroenterology and in the treatment of infectious arthritis.

5. Using freshly killed organisms and the bacterial filtrate as diluent should prove of more value in intradermal treatment, since the soluble toxins are incorporated with the bacterial protein.

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DISCUSSION

Dr. Edwin Beer: In connection with Dr. Nerb's remarks, the interest in Besredka's work was very great a few years ago, and it seemed as if he had found a panacea for all bacterial infections. In a number of cases filtrates were tried, as in osteomyelitis cases, and no effect was obtained. Whether the addition of intradermal injections would have made any difference, we cannot say on the basis of our experience.

Dr. Leo L. Michel: Dr. Nerb stated that though he had 100 per cent reaction from the injection of his bacterial filtrate the results were negative as far as the cure of the gonococcic infections were concerned. I am interested to know just what this reaction was. A few years ago I reported a series of gonococcal arthritides treated with non-specific proteins intravenously. Often the acute pain of the arthritis would disappear after but one injection: as a routine we gave a series of four injections about four days apart. The results were dependent upon the severity of the reaction, chill and fever, following the injection. Where we obtained a severe chill and high temperature, about 104° F., we had about 85 per cent good results. The pain of the arthritis would disappear. No known treatment gave us such quick results. It was also noted that if the urethral or cervical discharge of the patient was of a profuse or purulent character containing gonococci that in over 60 per cent of the cases treated with the non-specific proteins the discharge would abate and the gonococci would disappear provided we obtained severe reactions from the injections. As a result of these observations we call attention and do not hesitate to use a course of intravenous non-specific protein medication in those cases of Neisser infections, complicated or uncomplicated, wherein an early cure is imperative, usually about two weeks. It has also been my observation that posterior gonorrheal infections respond more readily to this method of treatment than do the anterior infections. May I again ask Dr. Nerb whether he obtained the same reaction with his bacterial filtrate that we obtained with our non-specific proteins?

Dr. Nerb (*closing*): In regard to the reactions we experienced by giving the gonococcus bacterial filtrate, I wish to say that we believe this is not due to any protein reaction, since it contains hardly any. Besides, we injected patients with a definite negative history of gonococcus infection, with the same filtrate, without showing any symptoms. Positive reactions are manifested by a distinct erythema and a swelling surrounding the injection lasting two to three days and even longer. We believe it is due to the specific toxins of the bacterial filtrate and not to a protein idiosyncracy.

This work is still, as far as we are concerned, in its experimental stage, but we hope to report better results in the future.

PROBLEMS OF PROSTATISM

SUGGESTED BY A STUDY OF 100 RECENT CASES*

N. P. RATHBUN, M.D.

BROOKLYN, N. Y.

AT this time, when cystoscopic prostatectomy is so definitely occupying the center of the stage, one wonders a little bit if a paper such as this is not obsolete before it is written. However, I am not as yet convinced that that is a fact. Of course we have all been profoundly impressed by the striking results which have been obtained and reported in large series of cases by Davis and others and the apparently slight risk and short period of hospitalization are very tempting. I think that men like Stern, Caulk, Davis, McCarthy and others who have contributed so much in one way and another to the standardization and applicability of this procedure are entitled to no end of credit. I do not think, however, that it is going to entirely replace, as is intimated by some of these gentlemen, other well-known and well-tried methods. Like all new methods, I believe it will eventually gravitate to its proper level and find its place, perhaps a large place, in the armamentariums at our disposal for the handling of these problems.

The few rambling thoughts presented in this paper are gathered in large measure from the 100 cases studied. Of course one cannot draw any conclusions from such a small group of cases but one who has been intimately associated with all of them does arrive at convictions, if not conclusions.

The series consists of 100 consecutive cases admitted to the wards and private rooms of my service at The Brooklyn Hospital and represents perhaps a fair cross section of what might be noted on any urological service. They are not presented in any spirit of pride of accomplishment (in fact our percentage of mortality and morbidity has been perhaps too high) but simply for what they are worth as a basis of discussion. It is my purpose to comment briefly on most of the data presented, a little more at length on some of the points upon which I have been particularly interested. The average age of this group was sixty-six, the oldest being eighty-three and the youngest forty-three. There were 55 cases of simple hypertrophy, 22 cases of fibrosis and hypertrophy, 5 median bars, 12 carcinomas, 5 cases of calculi occurring in fibrotic prostates (the diagnosis being entered on the records as prostatic calculi) and one case of suppurative prostatitis and vesiculitis with obstructive symptoms in which the patient was submitted to a resection of the bladder neck. This will be referred to later.

Of these 100 cases there were 15 patients who were not subjected to any form of surgery; two because we considered them inoperable. One of these was a carcinoma with very extensive bony metastases and a slight degree of obstruction; the other a simple hypertrophy, with complete obstruction, who did not improve sufficiently under prolonged catheter drainage to warrant operation. There were 4 cases in which operation was advised but declined. Some of these were cases admitted with acute retention and following relief by catheterization, signed their release and went home. There were 9 cases who were suitable candidates for surgery for whom we did not advise operation. I see a number of patients with mild symptoms and only a slight degree of obstruction, perhaps 1 or 2 ounces of residual urine, with a large soft boggy prostate, who can be kept comfortable almost indefinitely or even materially improved by massage, plus a few simple

* Read before the N. Y. Academy of Medicine, Section on Genito-Urinary Surgery, March 16, 1932.

hygienic measures. It hardly seems fair to subject these patients to the expense, discomfort and risk of surgery.

The remaining 85 cases were subjected to the following operative procedures: Cystotomy only, 10, with 4 deaths, a mortality of 40 per cent; cystotomy and radium, 3; radium by perineum, 1; one-stage suprapubic prostatectomy, 4, with one death; two-stage suprapubic prostatectomies, 60, with 5 deaths; one perineal prostatectomy and two bladder neck resections, with no deaths. The mortality will be discussed in a little more detail later.

A word about our method of preparation for operation, which I imagine parallels pretty closely the routine followed in most clinics: Practically all of our patients, even those with a small amount of residual urine, are placed at once upon an indwelling catheter and a bilateral vasectomy is done when the catheter is introduced. The period of catheter drainage in this series varied from 0 (a patient requiring immediate cystotomy for the evacuation of blood clots) to twenty-two days, with an average of seven days. Practically all of our cases which are not infected become mildly infected and we do not think that any harm is done. Two cases were admitted with an epididymitis. One case developed on the service during the period of catheter drainage. Since adopting this policy of doing a vasectomy when catheter drainage is instituted, we have had no case of epididymitis develop under our care.

In the two-stage prostatectomy group the period allowed to elapse between operations has varied from seven to 120 days, with an average of twenty days. We find ourselves gradually lengthening this period and have the experience common to other clinics that many bad risks are converted into good risks by prolonged drainage. This is of course one of the strong arguments in favor of a two-stage prostatectomy.

I shall not bore you with a detailed account of kidney function tests except to say that while we do them all, we rely particularly upon the concentration test and will not do a prostatectomy on any case with a range of less than six points.

Some of the preoperative complications have been interesting, one group, to my mind, of particular interest. There were 2 cases complicated by vesical calculi, which of course offer no special complication to a two-stage suprapubic operation; there was one large diverticulum for which nothing was done other than to remove the prostate obstruction, one case of tabes dersalis, in which prostatectomy seemed indicated and was done with an excellent result; 2 cases of diabetes mellitus, which under proper medical supervision does not seem to interfere materially with any form of urological surgery; 2 cases, two only, of syphilis as indicated by a positive blood Wassermann reaction. This did not seem in any way to complicate recovery. The most striking and to me the most interesting of the preoperative complications group were those involving the cardiovascular systems. Of these there were 21, which included: valvular disease 1, myocarditis 2, fibrosis of myocardium 2, bundle branch block 2, excessive hypertension 2, aortitis 1, aortic aneurysm 1 and general arteriosclerosis out of all proportion to the age of the individual 10. This to me is very striking and as has been suggested in other papers, might well have a bearing on the whole subject of prostatism, including etiology.

Anesthesia Employed: For our cystotomies and vasectomies local and field block have been used almost exclusively. For the suprapubic prostatectomies sacral, parasacral and abdominal field block has been the anesthetic of choice and most of our cases were done in this way, only one of the group requiring supplementary gas oxygen. Three cases were done with avertin alone and 6 cases with avertin supplemented by gas. While I like and employ avertin as a preliminary anesthesia rather extensively in younger patients, I am not very favorably impressed with it in prostatic surgery. Gas oxygen and ether were used in 5 cases on request from very nervous patients. Spinal

anesthesia was used in 8 cases with entire satisfaction. Some years ago we lost a rather important case from spinal anesthesia. This gave us a scare which it took a few years to recover from but we are now taking it up again and are so favorably impressed that it may eventually become our anesthetic of choice. While we have been well satisfied with sacral anesthesia, it is time-consuming and occasionally does not give the degree of muscular relaxation which is desirable.

Choice of Operation: As may be noted by the statistics presented, most of our cases (60 out of 85 operative cases) are handled by the two-stage suprapubic method. I assume that this is the method of choice for bad risks in practically all clinics and I think will probably continue in this role unless it is eventually replaced by cystoscopic resection.

If there is any one item which has contributed more than another to a lowering of prostatic mortality and morbidity it is the matter of preliminary decompression and drainage. While in many cases, for a short period of time, catheter drainage is adequate, in our hands, for one reason or another, it has not been satisfactory for cases requiring a long preliminary preparation. Certainly it is not practical for the occasional patient that is sent home for a period of two to three months before prostatectomy is undertaken. While the second step of the operation is more difficult and visualization is hampered or precluded, this is more than atoned for by the added factor of safety. We do an occasional one step suprapubic prostatectomy on younger patients who appear to be good risks and who tolerate an indwelling catheter well. There were 4 such cases in this group. There was only one perineal prostatectomy in the group. We rarely do this operation for no very good reason other than that we have gotten in the habit of handling most of our cases by the suprapubic route and feel more familiar with the problems involved. We have no fault to find with the men who prefer the perineal approach. There were 4 cases in which we did a transurethral punch operation. Two of these were hypertrophic median bars and the results were excellent. The other two were cases of fibrosis of the prostate and bladder neck and the results were not so good. This latter group of cases, and I think it is important to differentiate clearly between them and the hypertrophic bars, have been the most unsatisfactory with which we have had to deal. Many of these cases, some of which are represented in this series and many which are not, we have here approached through a wide open suprapubic approach. We have chewed out bits of tissue with the finger and the rongeur and have always felt that we had done a more or less unsatisfactory and unsurgical procedure. These patients have all been slow in healing and when they have finally left the hospital and reported at the office or the clinic, we have found them with the amount of residual urine materially reduced but the gross pyuria and, what is of infinitely more importance to the patient's point of view, the frequency and nocturia remain nearly if not quite as bad as before operation, in other words, an unsatisfactory result. This unfortunate experience has led me to welcome Crabtree's recent contribution. His own published statistics, together with my own very limited experience and that of a few others with whom I have discussed the matter, lead me to believe that it should be and will become the operation of choice in these very troublesome cases. It presents itself to my mind as a clean-cut, definite surgical procedure, which definitely and radically removes the cause. The various other procedures advocated do not pretend to remove all of the pathology and furthermore they provide the basis for more scarring and more fibrosis and further contracting. Perhaps the outstanding objection to the Crabtree operation is the risk of incontinence. If carefully and skilfully done, this risk should not be very great.

For our transurethral work, we have, up to the present time, preferred and employed

the Caulk cautery punch. It is simple, easy to handle and enables one to remove large bits of tissue quickly and easily. We make it a point to carefully inspect the operation area carefully with a cystourethroscope immediately after operation and tie in a catheter for from forty-eight to seventy-two hours. We have had no case of primary or secondary bleeding. It is quite possible that our choice of instruments may be influenced and perhaps changed by recent developments. I am not sure. There were only 2 cases in the group of bladder neck resections; one was a man with a fibrotic prostate complicated by calculi, who was in great distress from frequency, dysuria and a greatly distended bladder. He made a very smooth convalescence and now, six months after operation, the result is in every way absolutely perfect. The other patient was a man of forty-three with gross pyuria, 8 ounces of residual urine, a fibrotic prostate and distended seminal vesicles from which pure pus could be stripped by massage. He had been treated over a long period of time by massage and bladder washings and on two occasions he had been subjected by another urologist to punch operations. None of these measures had provided any relief. Four months following a resection of the bladder neck his urine is clear, he empties his bladder with a free easy stream and retains his urine all night. During the day he has an occasional slight dribbling when his bladder becomes filled. This trouble is rapidly improving.

Our cancer cases have of course been a problem. There were 12 of these in this group. In one case it did not seem that any form of surgery was indicated, there were extensive bony metastases, only mild frequency and a small amount of residual urine. There were 3 cases in which carcinoma was not suspected either before or during operation but in which small cancer areas were demonstrated in the laboratory. These patients all made good recoveries and are apparently remaining well. I have in the past seen a considerable number of such patients who have apparently remained well over long periods with no evidence of recurrence. On the other hand, I remember one patient not in this series in which carcinoma was not suspected, who turned up a year later with extensive bone lesions. A very careful recheck of the slides and the gross specimen again failed to demonstrate any evidence of malignancy. In other words, this diagnosis may easily be missed even in the laboratory. There were 3 cases in which carcinoma was suspected only but the diagnosis not definitely established. At operation the diagnosis was obvious but a partial suprapubic prostatectomy was done followed by the implantation of radium seeds through the perineum a week later, and the suprapubic wound allowed to heal. These patients made fairly smooth recoveries and left the hospital in fairly good shape. Their present condition is not on the whole very satisfactory. There were 3 cases of obvious advanced carcinoma with a high degree of obstruction upon whom a permanent cystotomy was done followed by radium repeated at varying intervals through the perineum. It is rather striking how comfortable many of these patients are with this arrangement and some of them carry on very well for two, three, four or more years before succumbing to the inevitable. There was one patient with only a slight degree of obstruction who was treated with radium only through the perineum. His is a recent case, still under observation, not doing very well and will probably eventually require a cystotomy.

Mortality: There were 11 deaths in this entire group, illustrating, as Keyes pointed out a few years ago, that the mortality of prostatism, if not of prostatectomy, is still high. One patient was moribund on admission and died without the aid of surgery.

There were 10 patients subjected to cystotomy only and in this group there were 4 deaths, a mortality of 40 per cent. This seems very high and yet we were not greatly surprised at it and believe that many other clinics have had a very similar experience. This simple operation seems to

carry with it almost universally a very high rate of mortality, not of course because of anything inherent in the operation itself but because of the poor risks upon whom it is performed. Whether or not this could be reduced by adopting a two-stage procedure as suggested by Keyes is a matter for thoughtful consideration. The causes of death in these 4 cases were:

Cardiac insufficiency and uremia	one
Coronary embolism (autopsy)	one
Pneumonia	one
Exhaustion incidental to toxic psychosis	one

There was one death from pneumonia, probably embolic, following a one-stage suprapubic prostatectomy for fibrotic prostate complicated by calculi.

In our group of 60 two-stage prostatectomies, there were 5 deaths, a mortality of 8 per cent plus, which is, of course, a bit too high. Two of these, one of pulmonary embolism (proved at autopsy) and one of pneumonia, appeared like "acts of God" and unavoidable. There were, however, 3 deaths from hemorrhage which were of course preventable and for which we feel a profound sense of responsibility. In one of these cases, a two stage suprapubic operation done under sacral and field block anesthesia, there was very little bleeding at operation and the patient left the operating room in good condition, with no bleeding and no provision made for it other than a wire spreader inserted for the purpose of keeping the wound widely open. Six hours later he had a furious hemorrhage and died in a few hours, in spite of a transfusion and packing. In another case of rather free bleeding at operation it was apparently controlled by a gauze pack. There was a moderate oozing all that day and the following morning but his general condition seemed reasonably satisfactory. On the afternoon of the second day there was a marked increase of bleeding with all the evidences of an acute anemia. Transfusion and repacking were carried out. He reacted fairly well to these measures for a while but the following day there was a marked tachycardia and hyperpyrexia and he died forty-eight hours after the repacking. In this case a serious heart lesion had been recognized before operation and it seems fair to assume that death in this case was due quite as much to cardiac insufficiency as to acute anemia. However, the fact remains that he would probably have gotten by if he had not had the hemorrhage. The last case was particularly tragic. The patient bled very little at operation but a gauze pack was placed in the prostate bed as a precautionary measure. He got along very well until the fourth day, at which time the pack was removed, followed immediately by a furious bleeding and death in a few hours in spite of the usual measures. These 3 cases have impressed me very deeply with the fact that bleeding is still a very serious menace in prostatic surgery. It has been my custom for several years to use a gauze pack in practically all cases and it has been reasonably satisfactory. However, 2 of the cases cited above, plus the discomfort incidental to its presence and its removal, led us to resume the use of the Pilcher bag more frequently. I am still afraid to leave them alone and trust to Nature and adequate drainage to take care of the bleeding, as is done in so many excellent clinics. Perhaps I am wrong on this point. I have had no personal experience with the various suture methods which have been recommended. Time will not permit a discussion of them but for various reasons I am not favorably impressed with them.

On the whole there is bound to be always a certain mortality in these cases, which is not entirely the mortality of an operation but, in a measure, the mortality of old age. I have at times gone on for months without a death only to have my pride humbled by two or three deaths in rapid succession. I take it that this has been the experience of all urologists and always will be and that a fair proportion of these deaths will be from pneumonia, emboli, angina, apoplexy, etc., which cannot be anticipated or prevented.

Other Postoperative Complications: I shall only dwell upon two of these in which I have been particularly interested. One of these is toxic psychosis, so called. I have always marveled at the paucity of literature upon this, which appears to me a very important problem. I have sometimes wondered if my experience is unique in that this complication gives me more annoyance and worry than is noted in other clinics. In the series under consideration there were 24 who presented definite evidence of mental disturbance. Thirteen of these were rated as mild; they pulled off their dressings, insisted upon getting out of bed, refused food and fluids, etc. They were easily handled and occasioned no anxiety. There were 4 cases more severe in type, requiring more or less constant attention, some measure of physical restraint and large doses of sedatives over periods varying from one or two days to as many weeks. There were seven that we rated as very severe. They were violently maniacal, difficult to manage and in each instance gave us many anxious days. One of these, a man of seventy-five, actively engaged in important work right up to the time of his admission to the hospital, developed a violent mania two days after a simple cystotomy. Notwithstanding the aid and counsel of the highest type of consultants in the urological, neurological and internal medicine fields, he went on with occasional short intermissions for nearly three weeks, when he died from sheer exhaustion. Throughout this entire period he ran a normal temperature, a normal blood count and a normal blood chemistry. I have had other similar deaths in other groups of cases studied. We have rarely noted this complication in our ward cases. It is usually noted in our private room cases and the most severe types in men of the higher types of intellects. We have assumed in all of our cases that we were dealing with some vague type of toxemia and on this assumption have adopted the policy of dilution and elimination as one basis of treatment, including forced fluids by the various channels, including transfusion, colonic irrigations, etc. plus, so far as is possible, change of environment, such as getting them out of bed, on the sun porch, in another room and in some cases where practical, removal to their own homes. Having had so much trouble with this complication, I have speculated considerably as to the factors involved. These patients all have, of course, varying degrees of cerebral arteriosclerosis and the immediate causative factor would appear to be, beyond any question, a disturbance in the cerebral circulation. The underlying factor or factors, however, are by no means so clear. That the cerebral changes are transitory would seem clearly proved by the fact that when and if these patients do recover, they recover completely and resume their usual places in life with unimpaired mental faculties. It seems fair perhaps to assume that all of these men have a certain amount of sepsis and a certain degree of renal insufficiency. Neither of these, however, are clearly shown by any of the physical or laboratory tests at present at our command. I have noted a slight lowering of the blood chlorides in a few cases and have occasionally noted some improvement following the use of hypertonic salt solution given by clysis. This, however, is by no means a constant factor. I have wondered too about the possibility of severe disturbance of endocrine balance but have no data on this point. On the whole this appears to me as a very important subject which has not received the attention to which it is entitled.

Seminal Vesiculitis: This is another complication of which one hears too little. There was only one case in this particular group, although I have seen a higher percentage in other similar series. This one case, a private patient, reported at my office a few weeks after his discharge from the hospital. His wound was well healed, he emptied his bladder with a full stream but his urine was very cloudy and he had marked dysuria, frequency and nocturia. Both vesicles were easily palpable and

tender. He improved rapidly following massage and bladder irrigations. This is a definite clinical entity, easily recognized and readily relieved by appropriate treatment.

CONCLUSION

This paper has of course, presented nothing that is startling or new. It has been our purpose to present briefly a cross-section of our work in this line, our problems, our methods of handling them, our results, such as they have been, plus a few somewhat ingrown convictions based on our experience and perhaps above all as a peg upon which to hang a discussion.

In conclusion, I wish to express my thanks to my associate, Dr. Frederick T. Bond, who has helped materially in reviewing the cases.

DISCUSSION

Dr. Oswald Lowsley: I find myself so in accord with what Dr. Rathbun said that I rise merely to agree with him in almost every paragraph of his paper. I agree particularly with his opening remarks. I think that suprapubic prostatectomies and perineal prostatectomies will always be done on the proper sort of case. I think that the newer methods will open up certain fields, of course, but after the preliminary enthusiasm dies out, it will assume its proper level, and while there may be a specific application for this method, particularly in cases of carcinoma and similar conditions, I think it will not become a universal method, leading to the discarding of all other types of prostatectomy. I wish particularly to comment on the 15 per cent of cases not operated on, 9 of which were not advised to be operated upon. That seems to me a particularly sane and proper attitude to assume toward this question. It seems to me that the criterion for operation upon the prostate should be based largely upon the residual urine and its accompanying evils. The mere fact that a patient has a large prostate, unless infection plays an unusual role, does not necessarily mean that that prostate should be removed by one or another method. It seems to me that Dr. Rathbun has struck an excellent keynote in that statement. I also feel as he does that the presence of heart disease, provided the heart is compensated, does not necessarily preclude operation in cases which are carefully prepared and drained up to the operative point. The toxic psychoses we have seen, just as Dr. Rathbun said, and it seems to me he is also perfectly proper in the suggestion that more attention be paid to them.

Dr. Edwin Beer: Dr. Rathbun's remarks covered practically the whole field of prostatic surgery, and apparently he is still skeptical as to the value of transurethral sections. I believe these are going to occupy a much bigger field than most of us realize, but at the same time it is probably not going to displace prostatectomy in the large bilateral adenomata.

The psychoses which follow prostatectomy in a small percentage of cases have been described by the Germans years ago as phrenitis prostatica. Though we have not seen as many as Dr. Rathbun, unfortunately we have seen quite a number, and they seem to be divided into two groups. One group seems melancholic and despondent, whereas the other is peculiarly hilarious. Some of them develop after the prostatic operation is completed and the wound closed, but usually they develop while convalescing, and the wound is still draining. Personally I have lost only one such patient who died of pneumonia recently, having been fed through a nasal tube on and off for almost two weeks. Whether these psychoses are based on arteriosclerosis of the cerebral vessels is hard to say, but it is probably on this basis. Dr. Rathbun reported on a case of a man who was perfectly well prior to a local anesthesia for cystotomy, but developed a fatal psychosis within a few days. It is difficult to understand how in such a case the psychosis could be attributed to cerebral arteriosclerosis, as it came on so quickly after a simple operation in a patient who had been perfectly well previously. It is easier to understand how a patient can develop, after a second stage operation, a psychosis, whether due to toxic absorption or fatigue, and in these cases one can more readily appreciate the fact that arteriosclerosis of the brain underlies the trouble.

In connection with hemorrhage, apparently Dr. Rathbun lost two patients who were operated upon under avertin anesthesia.

Whether the anesthesia was to be blamed for the bleeding is difficult to say, though it is very unlikely. In a review of over 60,000 avertin anesthesias in Germany, no definite mention of such an accident seems to be made. In damaged liver cases and damaged kidneys, one ought to go slowly in using avertin, even as a basal anesthesia.

In conclusion, my experience in general agrees absolutely with the remarks of Dr. Rathbun.

Dr. Irving Simons: I am interested in the fact that Dr. Rathbun had a large mortality in the first stage. I think anybody who reviews his records or goes over the past work carefully will agree that the mortality in the first stage is far more important and greater than that in the second stage; in spite of the fact that one may do everything he can to decompress the bladder, he is bound to have untoward symptoms if he does enough prostatectomies.

I was particularly interested in Dr. Rathbun's remark about the long drainage of cases. I think that prostates which are done in two operative stages, not counting the preliminary catheter drainage, are not drained long enough. I think a week is the shortest period one should allow. Certainly ten days to two weeks between operations is better. I once drained a case eleven months. The patient was allowed to go home, carried a Pezzer catheter for eleven months, and then came back and had a second-stage prostatectomy.

In regard to the question of the anesthetic, I wish to say that although I have used spinal anesthesia for a long time, I recently had a death which I attributed to spinal anesthesia, although I cannot prove it. In this case the patient went through the first stage easily under local anesthesia, and the second stage under spinal anesthesia was extremely easy, but within eight or twelve hours the patient developed a severe ileus. The stomach ballooned up and the patient succumbed the next morning.

The last point which was mentioned was the question of hemorrhage after prostatectomy. Some say that it is a negligible factor; others say that it contributes to death, but it is not the cause of it, and others say that hemorrhage causes death. Personally I have never had a death attributable to hemorrhage. I have never packed a prostate yet. I have depended entirely on irrigation, in spite of the fact that it has been condemned by many people. However, I do not use the ordinary solutions, and I have never had enough hemorrhage to cause alarming symptoms. I use alum, phenol, and camphor in the proportion of 97 per cent of alum to small amounts of phenol and camphor.

Dr. Rathbun (*Closing*): The only point I want to speak of is the matter of avertin anesthesia. The 2 cases which died following anesthesia died from hemorrhage, and whether or not the avertin had anything to do with it, I do not know, but probably it did not. I mentioned there had been three other deaths in the Brooklyn Hospital which I think were definitely due to avertin. I brought that out because it is becoming rather popular as an anesthetic in certain groups of cases, and it is just as well to sound a warning. I think avertin carries with it a very definite risk.

PERIRENAL HYDRONEPHROSIS*

CASE REPORT IN AN INFANT OF SEVEN MONTHS

MEREDITH F. CAMPBELL, M.D., F.A.C.S.

NEW YORK CITY

BY perirenal hydronephrosis is meant a cystic envelopment of the kidney in which the renal capsule forms the parietal cyst wall. The condition is also known as renal hygroma or hydrocele renis. In his description of the condition, Minkowski[1] compared the renal surroundings to those in scrotal hydrocele where the testes lie within the tunica vaginalis (Fig. 3). This admirably describes the findings in the case reported here, an infant of seven months examined urologically and operated upon under the erroneous diagnosis of malignant renal tumor.

CASE REPORT

B. J. female, aged seven months, was admitted to the Babies' Hospital November 12, 1929 because, for the past week, all feedings had returned by projectile vomiting. Her mother had recently noticed a small mass in the lower abdomen which rapidly grew in size to occupy much of the abdomen. The past history was negative.

Physical Examination: The patient was a well-developed, pale and irritable infant with enlarged tonsils and distended abdomen. The liver was palpable three fingers breadth below the costal margin. In the left loin was a grapefruit-sized mass extending from the costal margin to well below the umbilical level and anteriorly, in the median line, below the umbilicus (Fig. 1). The mass was not globular; it seemed pear shaped with the small end pointing toward the umbilicus. It was firm, smooth and seemed to have an overlying slight ridge (descending colon?). It was neither movable nor influenced by respirations. There were many enlarged superficial abdominal blood vessels and a few slightly enlarged inguinal lymph glands.

Urological Examination: Urinalysis: Clear; acid; sp. gr. 1,026; albumin; sugar, acetone, diabetes acid, 0; R.B.C. few; W.B.C. few; few hyalin and granular casts. Urine culture was sterile. The Kahn and tuberculin tests were negative. Blood Chemistry: Urea nitrogen 18.9 mg. per 100 c.c. of blood; chlorides 525; serum albumin 4.57; serum globulin 3.61. Blood pressure: systolic 105. Blood count: R.B.C. 3,976,000; hemoglobin 58 per cent; W.B.C. 12,900; polymorphonuclears 44 per cent; lymphocytes 55 per cent; eosinophiles 1 per cent. Plain urinary tract roentgenograms were normal.

Cystoscopy, November 16, 1929: Open drop anesthesia. The bladder urine and picture were normal. Both ureters were catheterized easily returning a hydronephrotic drip of clear urine from the left side. With aspiration, an ounce was withdrawn (the normal pelvis of a child this age contains not over 1.5 c.c.). Urine from right catheter was cloudy. Indigocarmine intravenously appeared in deep concentration from the right side in five minutes. The left catheter did not function well; no blue urine could be aspirated from this side in ten minutes. Ureter specimen reports were as follows:

	W.B.C.	R.B.C.	Urea, G. per Liter	Dye	Culture
Right ureter...	Rare	Rare	8.8	5 min. deep	Sterile
Left ureter.....	Rare	.....	2.8	.....	Sterile
Bladder.....	.....	.....	.....	.....	Sterile

Bilateral pyelograms (Fig. 2) showed a normal right upper tract with slight renal ptosis. The left ureter was dilated considerably throughout its length and displaced to the right, crossing the midline at the level of the fifth lumbar vertebra. Absence of kidney pelvis shadow indicated ureteropelvic junction obstruction.

[1] Minkowski, O. *Mitt. a. d. Grenzeb. d. Med. u. Cbir.*, 162: 260, 1906.

* From the Babies' Hospital and the Departments of Diseases of Children and Surgery, College of Physicians and Surgeons, Columbia Univ.

Diagnosis: Adenosarcoma of kidney. Nephrectomy advised.

Operation, November 19, 1929: A left rectus incision starting at the costal border and 15 cm. long was carried through the peritoneum, the viscera were walled off by pads, and the posterior layer of peritoneum opened. This layer was densely adherent to the tumor and peeled off with difficulty. The ureter was identified and found to be twice normal size; no point of compression or of stricture could be determined. It was mobilized for about 6 cm. below the renal pelvis where it was divided between clamps and ligated. The kidney consisted of a cystic mass about 20 cm. in diameter (Fig. 3) and was freed from surrounding adhesions with difficulty; it was densely adherent to diaphragm and musculature of the posterior abdominal wall. On accidental opening, many locules were seen. The contents (about 1500 c.c.) were serous. The pedicle was identified, ligated, divided and the kidney removed. The posterior peritoneum was closed with a continuous chromic suture after a rubber dam drain had been inserted into the kidney fossa through a posterior loin stab wound. The anterior peritoneum, fascia and skin wounds were appropriately closed.

Fig. 1. Patient of seven months. Left loin bulging. Size of loin mass is indicated.

Fig. 2. Except for renal ptosis, right upper tract is normal. There is moderate left ureteral dilatation and displacement with sharply obstructed ureteropelvic junction owing to ureteropelvic angulation. No pelvic shadow was obtained.

Following mobilization of the cyst mass, the patient manifested shock and expired when the operation was completed.

Specimen Report (Dr. Martha Wollstein): The specimen consists of a kidney measuring 8.5 cm. long by 3 cm. wide. It is stripped of its capsule and very pale. There are a few areas on the surface where the stars of Verheyen are congested. On section, the kidney substance is compressed and the calyces dilated. The pelvis is dilated and funnel shaped measuring 3 cm. in diameter. The ureter is of normal diameter at the outlet, and only 0.5 cm. of ureter is present. Attached to the pelvis by dense adhesions is a large empty cyst which measures 10 × 7 cm. It had been opened and drained at operation. It is multilocular with a smooth lining intensely congested in places, gray in others. The loculi vary in diameter from 7 to 3 cm. The outer surface of the wall is roughened by peritoneal adhesions and the outer coat is apparently serous in character. It

is impossible to find a communication between the cyst and the kidney pelvis or substance.

Microscopic examination of the wall of the cysts shows that it is composed of fibrous connective tissue carrying many blood vessels. The lining is a single layer of flattened cells present only over a part of the wall. Congestion of all the vessels is marked and hemorrhage into the connective tissue spaces has occurred. A thick portion of the wall contains much fat lobularly arranged between the connective tissue septa. There are many small, empty, dilated lymph vessels, and in one portion of the wall, a collection of such vessels suggests lymphagioma since the vessels are arranged in lobules. Throughout the wall there are small lymphoid collections. In the older connective tissue areas fibroblasts and plasma cells are present. Unstriped muscle cells are very few in number.

Section from the kidney shows compression of the substance, with irregular dilatation of the tubules. Their epithelium is partly peeled and has not the normal granular appearance of the lining of the convoluted tubules. The glomeruli are very irregular in size with congested capillaries. Fibrosis is not present but under the capsule condensation and compression are present. The connective tissue is increased in amount and is fibrous in some places. The collecting tubules are wide. The kidney pelvis shows a thick connective tissue wall but no acute inflammation.

COMMENT

Perirenal hydronephrosis is an uncommon condition; in 1923 Coenen and Silberberg[1] were able to find but 7 cases in the literature to which they added one of their own. The condition is usually unilateral, simulates abdominal or renal tumor, is seldom correctly diagnosed preoperatively and usually merits a favorable prognosis. Greatest interest focuses on the etiology which is as yet unsettled. The treatment is surgical.

PATHOLOGY

The pathologic anatomy of the condition has been indicated in the case report. Anatomically the lesion is to be differentiated from intrarenal cystic tumors although the clinical findings and import of the two conditions are similar. The cyst is always extrarenal and the fibrous capsule forms the parietal cyst wall (Fig. 3) although by capsule splitting, a portion of the capsule may still be adherent to or cover the cortex. Moreover, it must be distinguished from localized cysts adjacent to but not a part of the renal structure. The kidney parenchyma is compressed and may even show marked compression atrophy or anemia as in our case. With ureteropelvic or lower ureteral obstruction, intrarenal hydroenphrosis may co-exist as was noted in our patient.

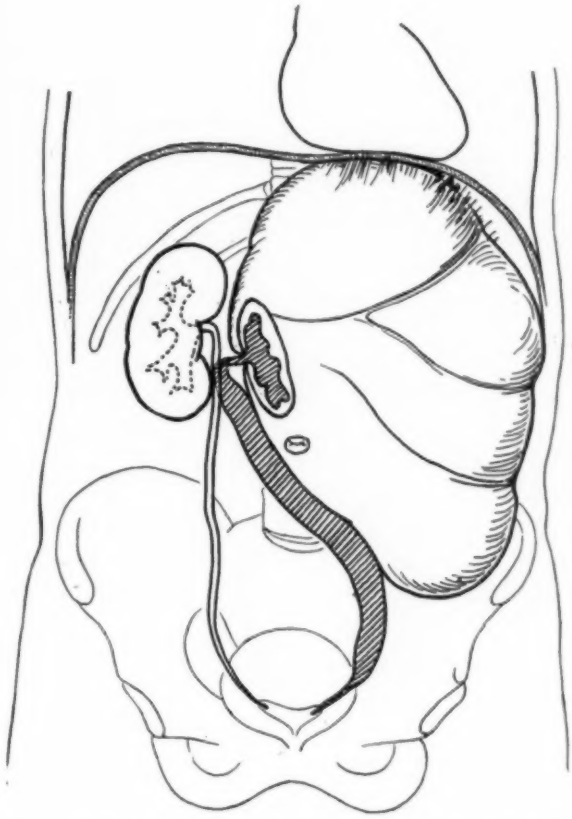

Fig. 3. Schema of surgical pathology. At operation the small flattened anemic kidney resembled a boiled shrimp. Renal displacement, cyst loculation, and diaphragmatic adhesions are noteworthy.

ETIOLOGY

The etiology is unknown. The early appearance of the lesion in our case suggests a congenital influence. Cyst origin in

[1] Goenen and Silberberg. *Beitr. z. klin. Chir.*, 130: 374, 1923.

nephrogenic anlagen is the usual explanation: in the (1) pronephric, (2) mesonephric, or (3) metanephric structures. Tubules which should normally be obliterated (1, 2) or should be fused with those of the collecting system (3) fail to become so. Thus normal glomerular drainage may be interfered with but may discharge subcapsular, thus inciting the perirenal hydronephrosis.

However, clinical comparison of the urine and perirenal fluid shows they are not the same; the latter conforms to a lymphatic exudate. Minkowski found that following benzoic acid ingestion, hippuric acid appeared in the urine but not in the cyst fluid and methylene blue appeared in deep concentration in the urine but faintly in the cyst fluid. Furthermore, following cyst emptying, urinary output remained normal while cyst filling proceeded at a rapid rate. It is evident, therefore, that when the cyst formation is not due to urinary extravasation or to fistulous connection with the renal pelvis, the cyst fluid is non-urinous.

The capsule may be loosened by trauma (obstetrical, for example) and, favored by an unusually rich hemovascular and lymphatic capsular supply, hemorrhagic or serous exudation may ensue with the ultimate development of a huge cyst dissecting capsule from cortex. Lymphstasis is believed to be the direct factor in exudative cyst formation. Such an explanation readily explains the anatomic findings in our case. McGrath and Apfelbach have recently recorded[1] a bilateral case associated with ureteral obstruction due to carcinomatous metastasis. In a few reported instances the cyst fluid was bloody. In perirenal hydronephrosis as here considered, there is no demonstrable connection between the cyst and the urinary channels. In some instances lymph-cyst development between the inner and outer layers of the renal fibrous capsule have been reported. Perirenal infection is also said to be a predisposing factor.

[1] McGrath, W. M., and Apfelbach, C. W. *Arch. Path.*, 11: 914, 1931.

SYMPTOMS

The symptoms are those of loin tumor. Rapid loin enlargement may be the only symptom. On the other hand, pain is often outstanding and may simulate cholecystitis, renal colic or, together with the abdominal mass, ovarian tumor. With bowel compression there may be constipation or actual acute obstruction. In our patient, gastric compression was manifested by projectile vomiting of all food. The urine and the urinary schedule are normal unless infection co-exists.

DIAGNOSIS

Palpation reveals a smooth loin tumor which, because of high fluid tension, may feel hard and neoplastic. The mass may occupy considerable of the abdomen and cause loin bulging (Fig. 1). Cystoscopy is apt to be negative unless an hydronephrotic pelvis is drained or the dye output diminished. We use indigocarmine for differential function estimation. Pyelography may show hydronephrosis, pelvic compression simulating tumor, displacement or, as in our case, complete ureteropelvic blockage with marked ureteral displacement. When the diagnosis is associated with the kidney, it is usually neoplasm; we made this mistake.

TREATMENT

When possible, excision of the cyst only is the indicated treatment. When, as in our case, the kidney is valueless, nephrectomy also is indicated. Because sudden evacuation of a large abdominal cyst is usually attended by profound shock, a two-stage operation is often wisest. This consists in preliminary cyst drainage (marsupialization is optional) with secondary excision of cyst (and kidney). Had this more conservative procedure been followed in our case, I believe the child would have survived; death resulted from shock.

The surgical approach varies with the size of the tumor. With large renal tumors,

transabdominal approach or anterolateral extraperitoneal attack is preferable. Medium sized tumors may be easily removed through the usual loin incision.

SUMMARY

Perirenal hydronephrosis is a rare condition and is usually misdiagnosed renal neoplasm. The reported case is of unusual interest because of (1) the striking local pathology and (2) the tender age of the patient—seven months. Furthermore, it illustrates the importance of urologic conditions in juveniles. The etiology of the condition is unsettled; maldevelopment from primitive renal anlagen, exudation due to lymphstasis, trauma and infection have been suggested. The usual methods of urologic diagnosis may be of little help or may support the diagnosis of renal neoplasm. Excision of the cyst sac, and the kidney as well when it is of no value, is the treatment. With large cysts, a two-stage operation, drainage with secondary excision, is the wisest course. Because a less conservative attack, a one-stage operation, was employed in our case, death from surgical shock resulted.

FOREIGN BODY (CHEWING GUM) IN THE URINARY BLADDER

REPORT OF TWO CASES

R. D. GILL, M.D., F.A.C.S.

WHEELING, W. VA.

THE finding of foreign bodies in the urinary bladder of either male or female is by no means uncommon.

FIG. 1. *X*-ray plate showing shadow in region of bladder.

Pieces of urethral or ureteral catheters or other surgical instruments have frequently been found and also various penetrating missiles such as shrapnel scraps and bullets. Another entirely different class of articles have been found in the bladder which have gained entrance thereto due to an accident during the course of masturbation or, as is occasionally the case, in a female during an attempt to produce an abortion.

A partial list, at least, of articles found in the bladder follows: Matches, hairpins, straight pins of all varieties, needles, both knitting and crochetting, nails, string, tar, wax, wax taper, lamp wick, pipe stem, tallow, collar buttoner, fountain pen clip, pencil, thermometer, glass rod, toothbrush handle, onion stalk six inches long, straws, sprigs of wheat, various weed stalks, pieces of penny, slippery elm stick, three caudal vertebrae of a squirrel and a hog's penis.

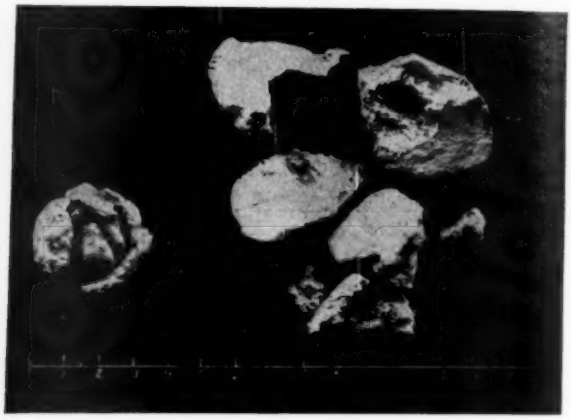

FIG. 2. Crushed calculus. On left, nucleus of chewing gum; on right, calcareous shell.

When I first discovered chewing gum in the bladder I thought surely it must be a novel experience. A brief reference, however, to the ever increasing literature on unusual cases revealed the fact that several cases had been previously reported by Ewell, Goodman, Gilbert, Gibson and others. Since than a second case has come under my observation and I would like to take this opportunity to report the two cases of this rather unusual foreign body in the urinary bladder.

CASE 1. Mr. C. F., aged twenty-one, single and a coal miner by occupation was admitted to the Ohio Valley General Hospital on September 23, 1927 complaining of painful and burning urination with marked perineal soreness and discomfort. The patient's symptoms were that of an acute posterior urethritis or prostatitis. Examination showed no urethral discharge and the patient gave no history of specific urethritis. However, after considerable questioning he admitted that while mastur-

bating three weeks previously he had inserted into the urethra a foreign body in the form of two sticks of chewing gum which had been thoroughly chewed and rolled into a cylindrical shape. Rather suddenly the chewing gum slipped from sight and reach and apparently worked its way into the bladder rapidly. There were few acute symptoms immediately. However, in a few days the patient began to suffer considerable pain on voiding, burning and a constant desire to urinate. He consulted his local physician who irrigated his bladder and gave him some medicine to dissolve the chewing gum. He thought he passed several small pieces of foreign materials in the urine. During the last week before my examination the patient's symptoms gradually increased in severity and during the last twenty-four hours there were chills and fever, marked soreness over the lower abdomen and in the perineum and marked pain on defecation as well as frequency, burning and urinary strangury. A three-glass test revealed all three glasses loaded with pus and blood and examination of the prostate showed it to be tense and exquisitely tender. The patient was cystoscoped, a No. 16 F. cystoscope having to be used on account of the unusual smallness of the external genitalia and the urethra. In fact a meatotomy had to be done before even this small scope could be introduced. There was an intense inflammatory reaction in the bladder and lying free in the bladder was a foreign body covered over with grayish white incrustations. The mass was of irregular shape and approximately the size of a prune. Due to the unusually small caliber of the urethra no operative instruments could be introduced and the chewing gum was removed by open operation. The patient made a very uneventful recovery and was discharged from the hospital in good condition.

Case II. Mr. A. B., aged twenty-three, single and referred by Dr. Gamble of Steubenville, Ohio, came in on January 14, 1932 and in the presence of his family gave a history of considerable bladder trouble of a year's duration. However, as soon as the patient was seen privately, he corrected his original history and frankly admitted that while masturbating a year ago using three sticks of chewing gum, the gum had entered the bladder and that his urinary trouble dated from that period. He stated that for a week or two following this accident his symptoms were very acute and there had been even passage of gross blood. The symptoms gradually subsided and for months, other than for moderate attacks of frequency and burning, he suffered no real discomfort. During the past two months his urinary difficulty had increased considerably in severity. At the time of examination there was marked burning and pain, a frequency of every hour during the day and night, occasional attacks of fever and chills and marked suprapubic pain and soreness. Examination showed no urethral discharge and a three-glass test showed marked infection in all three glasses. Examination of the external genitalia in this case also showed an unusual under-development for the age of the patient and the urethra was quite small, a No. 16 F. cystoscope being introduced with marked difficulty. As might be expected, the bladder mucous membrane showed a very marked reaction and the whole bladder floor, trigone and region of the bladder neck were covered over with purulent debris and there was a terrific bullous edema. Attached to the anterior or superior wall of the bladder just proximal to the bladder neck was a vesical calculus of slightly irregular shape, rounded and quite smooth. The calculus appeared to be about the size of a walnut and upon *x*-ray examination showed very clearly a soft center with a hard thick outer covering (Fig. 1). The urethra in this case being entirely too small to admit any crushing instrument, the stone was removed by suprapubic cystostomy and the patient made an uneventful recovery. The stone was crushed and in the center a soft sticky material, which was easily recognizable as chewing gum, was recovered. (Fig. 2.) The preservation of the gum was rather remarkable.

These two cases presented at least one physical finding in common and that is, both had very much under-developed external genitalia and both urethrae were very small, rendering introduction of any operative instrument impossible. In the majority of instances such materials can be removed readily through operating cystoscopes or with crushing rongeurs without resorting to open operation.

It is a well-known fact that any foreign body in the bladder very quickly becomes incrusted with urinary salts. Usually deposits of ammo-

nium magnesium phosphate appear within a few days. Rubber and vegetable materials and certain metals are most rapidly coated. In the case of chewing gum, if the patient is seen early before the calcareous formation has proceeded to any great degree, a solvent method may be used for its removal. It has been shown that a high grade of gasoline or carbon tetrachloride may be employed to dissolve chewing gum in the bladder with good results and without deleterious effects upon the bladder mucous membrane. In my first case the gum was heavily coated with phosphates and in the second case the gum was the nucleus of a rather large stone which rendered the solvent method impractical.

As chewing gum unquestionably is a very poor substance with which to masturbate, it is therefore found in urethrae and bladders rather rarely. It is interesting to note that in the second case reported the patient had used this material many times previously and at the time of his accident was practicing his art in the presence of and with three other masturbators, all of whom were using the same material. His partners in crime, however, were more fortunate and did not experience the embarrassing accident of "losing their gum." The first patient was a more modest individual and practiced his perverted habit alone and within the limits of his own sanctum sanctorum. He also had used chewing gum previously with good results and without accident.

So far as could be ascertained at this writing neither of these patients has resorted to this particularly crude and unnatural way of satisfying their sexual desires since his unhappy accident.

FIBROMA OF THE KIDNEY

REPORT OF A CASE

LESLIE V. RUSH, M.D. AND H. LOWRY RUSH, M.D.

MERIDIAN, MISS.

P. Mc C., an unmarried female, aged twenty-one, was referred to us October 29, 1930 for the removal of a gigantic abdominal tumor.

FIG. 1. Tumor.

The newgrowth was first noted fourteen years previously when it was perceptible as a small mass the size of the closed fist and could be palpated just beneath the left costal margin. At that time there were no symptoms attributable to the tumefaction. It had gradually and constantly increased in size until the time of examination. For the past few years there had been a constant feeling of malaise, and a sense of oppression in the left hypochondrium. There had been no digestive disturbances, and gynecological and urological histories afforded nothing of clinical interest.

Examination: The patient walked into the hospital and appeared to be a well-nourished, slightly obese individual suffering no pain. The thyroid gland was slightly enlarged. Examination of the lungs was negative. Dullness on percussion was elicited in the left mammary line below the fifth intercostal space and posteriorly there was dullness extending upward to the eighth interspace. This dullness was apparently attributable to a mass within the abdomen elevating the diaphragm on the left side.

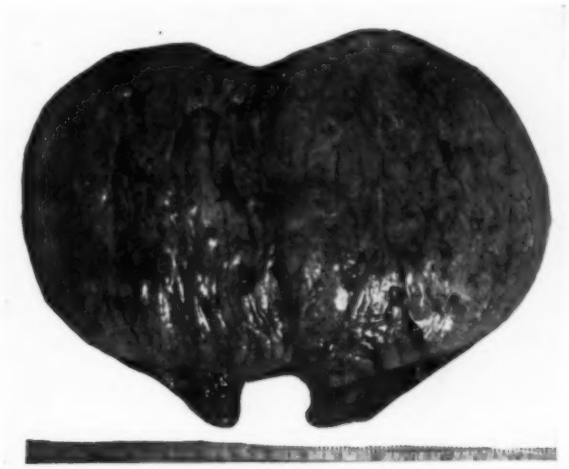

FIG. 2. Tumor, showing cut surface.

This mass could be felt through the abdominal wall as a large, firm, slightly tender tumor, occupying the entire upper left quadrant of the abdomen and extending well up beneath the left costal margin. The lower border could be felt to pass from the left renal area downward into the lower part of the abdomen and over into the right lumbar region. The mass was slightly mobile. A tympanitic note was heard on percussing the area extending between the tumor and the area of liver dullness. The vaginal hymen was present.

Laboratory Findings: Examination of the blood showed 85 per cent hemoglobin, coagulation time three minutes, total red blood cell count 4,000,000 per cubic millimeter, total leucocyte count 7700, with a normal differential cell count. There was slight poikilocytosis, but no anisocytosis nor stippling of the red blood cells. Urinalysis was negative.

Operation: Under ether anesthesia an incision was made beginning in the midline and carried

to the left in a curvilinear fashion about one inch below the left costal border and extended into the left lumbar region, posteriorly. The

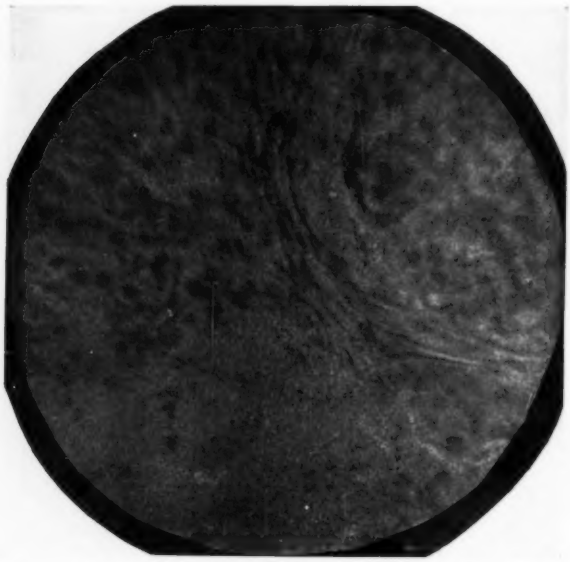

Fig. 3. View of cortex of kidney, showing albuminous degeneration.

Fig. 4. View of base of medullary pyramid, point of origin of tumor, showing amyloid degeneration in collecting tubules.

intestine was attached to the growth at a great many places by fibrous adhesions which were severed as they were encountered. The tumor was found to extend well up beneath the left costal margin and was delivered through the incision with some difficulty. The pedicle of the tumor contained the ureter and renal vessels. After it was determined that the right kidney was present and of normal size and consistency a left nephrectomy was done.

The patient reacted well following her operation and her convalesecnce was almost uneventful. She left the hospital on the sixteenth postoperative day.

Pathological Report: The tumor was of a grayish yellow color and covered by peritoneum. It measured $11 \times 9 \times 9$ inches and weighed 13 pounds. The cut surface showed it to be of fairly firm consistency and composed of grayish yellow material. Several large blood vessels could be seen showing passive congestion. At one portion of the periphery kidney tissue could be identified. (Fig. 2.)

Microscopic: The report of Dr. W. W. Robinson of Memphis, Tenn. was as follows:

(1) Kidney: Parenchyma: Diffuse albuminous degeneration of the renal epithelium, especially in the convoluted tubules of the cortical pyramids. Bowman's capsule of the Malphigian corpuscles shows intracapsular distention. In the base of the medullary pyramids, from which area the tumor arises, there are amyloid deposits in most of the straight or collecting tubules with much exfoliation of the lining cuboidal epithelium. Many of the medullary tubules are obliterated by fibrous connective tissue replacement, or dilated to form cysts. Scattered foci of lymphocytic infiltration are noted.

Stroma: Passive injection of the blood supply with minute deposits of hemosiderin pigment in the renal epithelium of the convoluted tubules. There is no thickening of the fibrous trabeculae of the renal cortex.

(2) Tumor of Kidney: The type cell is the fibroblast, the differentiation of which is normal. These are diffusely disseminated and widely separated by collagen fibrils and mucin deposit. The latter represents a myxomatous degeneration, as no active myxoblasts occur. No mitosis or other evidence of anaplasia is present. Many plasma cells occur.

Stroma: The tumor is separated from the renal parenchyma by fibrous connective tissue formation about the mesial portions of the collecting tubules. The blood supply consists of many capillary vessels, some of which are dilated and injected. The mucinous degeneration in the tumor is most conspicuous.

Pathological Diagnosis: (1) Diffuse albuminous and amyloid degeneration of the kidney. (2) Fibroma of the kidney with myxomatous degeneration. So-called myxoma fibromatosum, benign.

DISCUSSION

The following cases taken from the literature are of interest:

Perinephritic Tumors	Weight (Lbs.)
Hirsch and Wells	69
Billroth (reported by Salzer)	63.8
Waldeyer	63
Homans	57
Vogelweid	55
Cantoni	55
Demoulins	53
Windle	50

Tumors Arising from Kidney Capsule:

Thomas: Fibroma apparently arising from the renal capsule "the size of the uterus at the eighth month of gestation."

Wilkes, 1869: Growth size of child's head within the renal capsule. Consisted of fibrous tissue.

Bruntzelle, 1882: Fibroma of renal capsule. Weight 37.5 lbs.

Tumors Arising from Kidney:

Thomas, 1882: myxofibromatous cyst. Weight 5.5 lbs.

Ochsner, 1899: Leiomyofibroma. Weight 10 lbs. 5 oz.

Kukudshanoff, 1928: Fibroma. 12 × 8 × 6 cms.

Steinle, 1929: Fibroma. Diameter 10 cms.

Ravich, 1930: Angiofibrolipoma. 18 × 14 × 5 cms.

Gordon-Taylor, 1930: Adenofibroma. Weight 22 lbs.

Although multiple small fibromata of the kidney are not unusual it is very rarely indeed that the surgeon meets with large benign tumors of the kidney. Perinephritic tumors and tumors arising from the renal capsule sometimes assume collossal proportions. The largest perinephritic tumor on record is that of Hirsch and Wells weighing 69 pounds. The largest benign tumor arising from the renal capsule is that of Bruntzelle weighing 37.5 pounds. Gordon-Taylor described the largest benign tumor arising from the kidney, an adenofibroma weighing 22 pounds. Our case, we believe, is the largest fibroma of the kidney on record.

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A RESUMÉ OF

SPINAL ANESTHESIA

W. N. KEMP, M.D.

VANCOUVER, B. C.

AN effort will be made in this paper to briefly cover the salient features of spinal anesthesia or subarachnoid block. The subject will be considered under the following headings: (1) indications and contraindications; (2) technique of induction; (3) the physiology of subarachnoid block; (4) operative complications and their treatment; (5) postoperative complications and their treatment.

1. INDICATIONS AND CONTRAINDICATIONS

(a) *Indications.* Spinal anesthesia has been used for operations on every part of the body. However it would seem to be more rational, where anesthesia of the head and neck are required to use either some form of local or paravertebral block or a suitable general anesthesia. A considerable number of surgeons use spinal anesthesia for thoracic surgery. Here again it is probable that gas-oxygen or avertin and local novocaine infiltration are preferable. At the Vancouver General Hospital we have confined the use of spinal anesthesia to operations below the diaphragm. In this field it is valuable in cases where general anesthesia may be contraindicated and is of special value in operations for intestinal obstruction, gunshot wounds of the abdomen, and in orthopedic surgery on, and the reduction of fractures of, the lower extremity.

(b) *Contraindications.* The use of spinal anesthesia is contraindicated in patients who have suffered from recent severe hemorrhage such as ruptured ectopic gestation cases. R. M. Waters, Chief Anesthetist at Wisconsin State Hospital, is of the opinion that a systolic blood pressure over 175 mm. Hg is a contraindication to the use of spinal anesthesia. Patients with hyperpiesis do not stand well the drop in blood pressure that often accompanies a spinal anesthesia. In this respect the locus of the operation would have a bearing on the question of choice anesthetic. For the amputation of a lower extremity, for example, a low spinal anesthesia in which there is little disturbance of blood pressure level can be satisfactorily used. Any local inflammatory process in the skin or deep tissues of the lumbar region or any inflammatory condition of the spinal cord or meninges is, of course, a very definite contraindication to the use of subarachnoid block.

2. TECHNIQUE OF INDUCTION

Sise, Evans, Labat, Lundy, Waters and other spinal anesthetists emphasize the importance of the use of a fine rustless needle in performing the lumbar puncture which is done in lumbar interspaces II, III or IV. L. F. Sise[1] of the Lahey Clinic is the originator of an "introducer," a short sharp needle-like instrument which is used to pierce the supraspinous and infraspinous ligaments and through which the fine 22 gauge spinal puncture needle gains easy access to the meninges of the cord.

Although novocaine is the anesthetic agent usually employed in subarachnoid block, there are three modifications of this drug in common use: (a) the use of a solution of novocaine made lighter than spinal fluid, as "spinocain"; (b) the use of a solution of novocaine made heavier than spinal fluid by the addition of glucose or some other sugar; (c) the use of novocaine crystals dissolved in spinal fluid itself. We have not used spinocaine at the Vancouver General Hospital. The use of various sugars to make the novocaine solution heavy

offers no practical advantage over the use of pure novocaine crystals dissolved in spinal fluid.

The height of the anesthesia (and muscular relaxation) is principally controlled by the quantity of spinal fluid withdrawn and reinjected; viz., 1 c.c. for leg amputation or perineal and anal operations; 3–4 c.c. for a prostatectomy or herniorrhaphy; 4–5 c.c. for an appendectomy; 8–10 c.c. for a cholecystectomy or a gastric operation. It will be observed that the latter "expansion" (i.e. the volume of spinal fluid withdrawn) will in the later stages of the operation at least, *give a cutaneous anesthesia of the whole body*. It is by this method that the so-called high spinal anesthesias are obtained.

The *duration of anesthesia* is in direct ratio to the quantity of novocaine injected: 150 mg. give anesthesia for thirty to forty-five minutes; 300 mg. give anesthesia for seventy-five to ninety minutes (approximately). King[2] gives the lethal intrathecal dosage of novocaine as 55 mg. per kilo of body weight. A dose of 300 mg. of novocaine for an adult weighing 150 lbs. is, accordingly, but one-tenth of the lethal toxic dose. The untoward complications of spinal anesthesia are attributable to the undesirable high nerve block induced by a concentrated solution of novocaine in the upper third of the subarachnoid space, rather than to the toxic action of the drug itself. The latter is undoubtedly a factor in certain patients hypersensitive to novocaine.

The *preliminary subcutaneous injection of ephedrine* in ¾ to 1 grain dosage is commonly advised. Opinion is divided as to its value. Indeed some men are of the opinion that its use is contraindicated at any stage of spinal anesthesia. Labat[3] stated at a recent meeting of the Regional Anesthesia Society of New York that he had never used ephedrine in a series of 3000 spinal anesthesias, and that he was dubious of its much advertised value in spinal anesthesia. Chen and Meek[4] have shown by electrocardiographic studies that it produces a progressive paralysis of the cardiac conduction bundle with the ultimate production of ventricular fibrillation, in experimental animals in large doses. It is quite possible that in its use in spinal anesthesia, a heart already handicapped by anoxemia or organic disease, or both, may be only further poisoned by such a drug as ephedrine. Equally important to the above-mentioned objections is the probable fact that ephedrine has no beneficial effect whatever upon the low blood pressure of the patient under spinal anesthesia. Indeed its action in the presence of the anoxemia that often accompanies spinal block is probably deleterious.

The question of posture following the induction of the spinal anesthesia is of considerable interest. When novocaine crystals and volume-control technique as already outlined are used in the induction of the spinal block the subsequent posture of the patient is of *little importance as far as its effect upon the height of the anesthesia is concerned*. Labat puts all of his patients in the Trendelenburg position immediately following the induction of the block. He argues that he thus insures the blood supply of the vital centers regardless of subsequent fall in systolic blood pressure. In the light of the theory that the drop in blood pressure that so often occurs is largely due to anoxemia the use of a marked degree of the Trendelenburg position is contraindicated on account of the embarrassment that it adds to an already lethargic respiratory action. A 6 or 8 inch depression of the head and shoulders is of definite value.

3. Physiology of Spinal Anesthesia

A reasonably sound theory of the physiological action of intrathecal novocaine is essential to the intelligent use of subarachnoid block. The commonly accepted theory that novocaine produces skeletal and vascular muscular atonia by its action upon the motor (ventral) roots is probably erroneous. The theory outlined by A. I. Willinsky[5] is much more acceptable. He points out that all the phenomena inci-

dental to spinal anesthesia may be explained by the selective action of novocaine upon the sensory (dorsal) roots alone. The affinity of novocaine and cocaine and such chemically related anesthetic drugs for sensory nerve tissue is well known. Years ago Santesson[6] showed that direct contact with 5 per cent solution of cocaine hydrochloride broke sensory conduction so completely in the sciatic nerve, that the strongest tetanic stimulation peripheral to the treated area was no longer able to produce a reflex, while the same concentration of cocaine left the motor conduction unchanged for at least one hour. The independent experiments of Kochs,[7] Hitzig,[8] and Bernstein[9] many years ago showed that anesthetic drugs of the benzol group, of which cocaine was the most used, affect almost exclusively the sensory elements in the nervous system. As Willinsky states:

> It would be reasonable to postulate from the pharmacodynamic evidence of the elective affinity of the cocaine group for sensory nerve tissues, that the brunt of the action of novocain in the subarachnoid space would be on the dorsal roots. From this standpoint alone, we are justified in assuming that the tendency of novocain would be that of blocking the posterior nerve roots and permitting conduction through the anterior (motor) nerve roots.

What of the paralysis and loss of muscle tone that occurs after spinal block? This is rationally explained by the selective action of novocaine for the dorsal roots. Starling[10] was the first to demonstrate the fact that section of the dorsal roots causes loss of muscular tone and paralysis of the related muscles, due to breaking of the reflex arc so essential to tonus and contraction of the muscles. In blocking the sensory (afferent) nerves of the dorsal roots, novocaine produces the effect of a temporary section of the dorsal roots with its consequent muscular dysfunction.

Sherrington[11] has classified the filaments of the dorsal roots from the functional viewpoint, into three broad groups:

(a) *Interoceptive fibers:* carrying afferent sensory impulses from the viscera.

(b) *Exteroceptive fibers:* carrying afferent sensory impulses of pain, touch, heat and cold from the cutaneous surface.

(c) *Proprioceptive fibers:* carrying afferent impulses of deep sensation or muscle sense essential to the reflex arc and muscle tone and contraction of muscle.

Willinsky[5] has shown that if only 40 mg. of novocaine, dissolved in 4 c.c. of spinal fluid, be injected into the subarachnoid space at the level of the second lumbar interspace, anesthesia of the skin of the abdomen is obtained but there is no loss of muscular tone and no paralysis of the muscles of the lower extremity or the abdomen. As a result of this injection of novocaine, the exteroceptive afferent sensory impulses from the skin of the abdomen are blocked but the concentration of novocaine is not sufficient to block the more resistant proprioceptive fibers. Ranson,[12] by the use of special staining methods, has shown that only the proprioceptive filaments in the dorsal roots have a myelin sheath. Ingvar[13] has confirmed these findings and they have been accepted by Hauptman.[14] This anatomical fact can explain the relative delay noted in spinal anesthesia between the speedy loss of cutaneous sensation and the slower loss of deep pressure sense.

Clinical experience shows that if 150 mg. of novocaine be dissolved in 4 c.c. of spinal fluid and be injected intrathecally as in the foregoing 40 mg. injection, not only will there be complete cutaneous and deep anesthesia of the lower limbs with cutaneous anesthesia of the abdomen, but also a coexisting flaccid muscular paralysis of the extremities and lower abdomen. By the use of 150 mg. of novocaine a concentration of the drug in the subarachnoid space is obtained that is sufficient to penetrate the protective myelin sheathes of the proprioceptive fibers in the adjacent dorsal roots and the result is a functional section of those fibers and an inevitable loss of tone and temporary paralysis in the correlated muscles. It will be noted that the zone of cutaneous anesthesia extends to the costal

margin or higher while the zone of muscular relaxation extends only to the umbilicus. According to this principle of the intrathecal action of novocaine, when 200 to 300 mg. of novocaine are dissolved in 8 to 10 c.c. of spinal fluid and reinjected to produce satisfactory relaxation and anesthesia for a cholecystectomy, there occurs a complete block of exteroceptive, interoceptive and proprioceptive fibers of the lower two-thirds of the body and a block of the exteroceptive and interoceptive fibers only in the upper third. This complete loss of cutaneous sensation under the conditions outlined for this operation can be easily proved in the clinic. In other words, this constitutes one of the so-called high spinal anesthesias under which some ultra-enthusiasts perform tonsillectomies and mastoidectomies. The relative safety of this form of anesthesia depends upon the fortunate possession of the proprioceptive fibers of the respiratory mechanism of a myelin sheath which makes them immune to the relatively dilute concentration of novocaine which is always present in the upper third of the subarachnoid space when the anesthetic technique just outlined is used. If the concentration of novocaine in the upper third of the subarachnoid space is sufficient to block the afferent proprioceptive fibers upon whose integrity respiratory muscular activity depends, a real temporary respiratory paralysis will obtain.

4. Operative Complications of Spinal Anesthesia

These will be considered under the following subtitles:

(A) The fall in systolic blood pressure.
(B) Nausea and vomiting.
(C) Respiratory failure.

(A) *Fall in Systolic Blood Pressure.* This is a common accompaniment of a spinal anesthesia produced for abdominal operation. The commonly accepted teaching in regard to this fall in blood pressure is to the effect that the block of the vasoconstrictor fibers in the ventral roots causes a vasodilatation in proportion to the number of vasoconstrictor fibers blocked by the intrathecal novocaine. This theory is absolutely contrary to sound physiological reasoning and is moreover at direct variance with actual fact as observed under spinal anesthesia in the clinic. The reasons for rejecting this theory of the etiology of the fall in blood pressure may be summarized as follows:

(1) The vasoconstrictor fibers from the vasoconstrictor nuclei in the cord and medulla leave the cord from the anterior horn by way of the ventral roots. They are distinctly myelinated. They form synapses with cells in the sympathetic ganglia and as postganglionic fibers are distributed to the various arteries and arterioles of the body. The nervous control of the vascular musculature is manifested through varying degrees of pressor and depressor impulses of central origin. It is impossible to conceive of a general vasodilatation of central origin without the media of depressor impulses. The latter are antidromic, that is they reach their vascular terminus by way of the sensory nerves of the dorsal roots. As has been indicated by Willinsky's work the latter are the first to be blocked by the intrathecal novocaine. Therefore, on anatomical and pharmacodynamic grounds it can be postulated that no vasodilatation of central origin occurs under subarachnoid block.

(2) It is the experience of most observers that a *vasoconstriction* rather than a vasodilatation actually occurs under spinal block. This has been commented upon favorably by many surgeons.[15]

To what can we ascribe this often very marked drop in arterial blood pressure that may accompany spinal anesthesia? Recent researches conducted by Seevers and Waters,[16] pharmacologist and chief anesthetist respectively of Wisconsin State Hospital, prove that tissue oxygen-want is mainly responsible for the fall in systolic blood pressure. This lack in tissue oxygen supply is due to impaired respiratory exchange, which, in turn, is caused by the following factors:

(a) Loss of all or nearly all external stimulation from the skin through blocking of the exteroceptive fibers. The block of the interoceptive fibers from the pulmonary parenchyma may also be a factor in respiratory decline.

(b) Upset in thoraco-abdominal pressure relations caused by opening the peritoneum.

(c) Reflex inhibition of the diaphragm from the operative procedures.

(d) Use of extreme Trendelenburg position and tight upper abdominal packs.

(e) Premedication used.

The researches of Dale and Richards[17] and of A. Krogh[18] have established the following facts:

(a) That the capillaries are capable of dilating or constricting independently of the arterial tree.

(b) That the normal condition of tonus under which the capillaries work is due to a *circulating hormone which is probably pituitrin.*

(c) That the most potent factor in causing capillary dilatation is *oxygen-want.*

(d) An alteration in the H-ion concentration (pH) of the tissues as would be caused by the accumulation of CO_2 or lactic acid is another potent factor in maintaining capillary dilatation and in causing an alteration in permeability of the capillary walls, which in turn permits the transudation of lymph from the blood stream and a resulting oligemia.

Other probable contributory causes to the fall in systolic blood pressure are:

(1) Slowing of the heart from relative parasympathetic (vagus) preponderance in the absence of the stimulatory sympathetic action cut off by the block.

(2) Loss of tone in the skeletal musculature, which tonus is one factor in the normal maintenance of systolic pressure.

(3) Loss of the normal assistance afforded to the return flow of venous blood to the left heart by the aspirating effect of the normal thoracic movements.

(4) Manipulation and traction on the viscera during operation.

To summarize it may be said that recent researches in spinal anesthesia, capillary action and the production of histamine shock, might reasonably lead to the formulation of the following theory of the cause of the fall in blood pressure in spinal anesthesia: That the fall in blood pressure under spinal block is a form of shock to which the term "spinal anesthetic shock" might well be given (all shock being essentially due to excessive and general capillary dilatation with the transudation of lymph and plasma and a resulting oligemia); *"spinal anesthetic shock"* is primarily due to anoxemia and venous stasis resulting principally from decreased respiratory exchange incidental to the spinal block and the operative procedures; anoxemia acts by initiating capillary dilatation and stasis; anoxemia and stasis result in increase in H-ion concentration of the blood[19] and tissues and alteration in capillary permeability with transudation of lymph and plasma colloids; this creates an osmotic pressure in the tissues that attracts more lymph from the blood: Thus becomes established a vicious circle of depressed respiratory function: anoxemia and tissue oxygen-want, capillary dilatation and stasis, increased H-ion concentration of the blood, increased permeability of the capillary walls, transudation of blood lymph and blood colloids, increased osmotic pressure in the tissues attracting more lymph from the blood, a general marked decrease in the volume of circulating blood (oligemia), a fall in arterial blood pressure from oligemia (the manifestation of the clinical signs of shock are mainly pallor from arterial vasoconstriction and fall in blood pressure from oligemia), further weakening of the cardiac efforts by the persisting low arterial pressure (the heart requires a minimum pressure of 90 Hg systolic for efficient function of the cardiac musculature), increase in CO_2 content of the blood (hence increased H-ion concentration) as a result of continuing venous stasis and anoxemia, increased dissociation of oxyhemoglobin and consequent diminu-

tion in its capacity to carry oxygen. Thus oxygen want is the starting point and finishing point in the vicious circle of spinal anesthetic shock.

Treatment for Spinal Anesthetic Shock. This may be considered under two heads:

(a) Prophylactic treatment

(b) Immediate treatment.

(a) *Prophylactic treatment* consists of the following measures:

(1) Encouragement of deep breathing by the patient

(2) Use of a minimal amount of premedication.

(3) Non-use of a marked degree of Trendelenburg Position.

(4) Obtaining of the surgeon's cooperation in the omission of tight upper abdominal packs that restrict the free movement of the diaphragm and in the avoidance of excessive visceral manipulation and traction.

(5) The use of prophylactic intravenous infusions of saline especially in the presence of a real blood loss.

(b) *Immediate treatment* consists essentially in active measures to relieve the anoxemia. This is best accomplished by the exhibition of oxygen inhalations through the gas machine. The researches of Krogh on capillary constriction and dilatation would indicate that *pituitrin* is the normal hormone maintaining capillary tone. Consequently, if a peripherally acting drug is desirable for subcutaneous injection pituitrin is the logical drug to use. Adrenalin, although it causes a temporary rise by vasoconstriction of the arteries and arterioles, ultimately increases the capillary dilatation.[20] It is possible that ephedrine being pharmacologically akin to adrenalin, has the same unwanted action upon the already dilated capillaries. Regardless of the possibility of this dilating action of ephedrine on the capillaries, it is a well-established clinical fact that ephedrine is useless in the restoration of the fallen blood pressure of spinal anesthetic shock. Labat uses nothing but postural treatment in cases of spinal anesthetic shock. He considers that, since the blood pressure always comes back to near the normal level when the anesthesia wears off, the maintenance of a blood supply to the vital centers by the Trendelenburg position is the only essential. However, it appears rational that active steps should be taken to restore, as far as possible, normal circulatory and respiratory function. The incidence of postoperative pneumonia has been found to be as great or greater under spinal as it is under ether anesthesia. Probably the prolonged venous stasis and diminished expansion of the lungs which has been a feature of many spinal anesthesias is the factor which predisposes the patient to this unexpectedly high incidence of postoperative pulmonary complications.

(B) *Nausea and vomiting* during the operation may be due to anoxemia, to the fall in blood pressure or to visceral manipulations. The inhalation of deep inspirations of air or oxygen is usually of immediate benefit.

(C) *Respiratory Failure.* A cessation of respiration may occur under spinal block. When it occurs it is usually momentary if immediate steps are taken to offset it. If the novocaine in concentrated form reaches the posterior roots in the upper thoracic and cervical segments the proprioceptive fibers of the diaphragm and the accessory muscles of respiration will be blocked and a true respiratory muscular paralysis will occur. This form of respiratory paralysis is easily demonstrated by injecting huge doses of intrathecal novocaine (1250 to 2500 mg.) into laboratory dogs.[16] Although total paralysis of the central nervous system soon occurs the animal can be kept alive and in good condition with no appreciable change in blood pressure if he be placed in a modified Drinker respirator. The animal's normal respiratory mechanism is usually re-established in five or six hours as the high effect of the block wears off. The conclusion to be drawn from this laboratory experiment is obviously that in the most unusual event of such a real respiratory paralysis occurring clinically the

remedy is artificial respiration combined with the intratracheal insufflation of oxygen until such time as the normal respiratory mechanism becomes established. This form of respiratory failure must be of very rare occurrence. The *momentary* but none the less dangerous form of respiratory failure is not so rare. It is not a paralysis due to nerve block as is the form of respiratory paralysis just described. It can best be described as a complete respiratory inertia occurring suddenly with loss of consciousness and the eye signs of fourth stage ether anesthesia. This emergency is best handled by the insufflation of the lungs with oxygen under positive pressure through the face mask of a gas machine. In the absence of a gas machine W. R. Evans[21] recommends mouth-to-mouth insufflation in perference to artificial respiration even with intrapharyngeal oxygen.

5. POSTOPERATIVE COMPLICATIONS AND THEIR TREATMENT

(A) *Postoperative Headache.* This is sometimes a very annoying and persistent postoperative complication. For purposes of diagnosis and treatment, postoperative headache may be divided into two categories: (a) *lumbar puncture headache;* (b) *meningitic headache.*

(a) *Lumbar puncture headache* is the most common form of postoperative headache and, according to Evans,[21] it is preventable in 95 per cent of cases by the adoption of a careful and precise lumbar puncture technique. Most important in its prevention are the following:

(1) Good preliminary cutaneous anesthesia.

(2) The use of a fine spinal puncture needle.

(3) The maintenance of the head and shoulders at a level 6 or 8 inches below that of the pelvis for twelve hours after induction of anesthesia.

Diagnosis of lumbar puncture headache is made when the patient complains of an occipital or parietal headache which appears during the first twenty-four hours, which gradually increases in severity, which is definitely worse when the head and shoulders are raised but *which disappears when they are lowered to a level below that of the rest of the body.* This type of headache is generally considered to be due to loss of spinal fluid.

Treatment consists of the following measures:

(1) Lower the head and shoulders for twenty-four hours.

(2) Force fluids, intravenously and by mouth. In intractable cases Evans[21] recommends 100 c.c. of a 0.5 per cent saline intravenously.

(3) Eliminate excitement.

(b) *Meningitic headache,* in contrast to the lumbar puncture type, is due to *increased* spinal fluid pressure caused by chemical or bacterial irritation of the meninges.

Diagnosis. It is associated with the cervical rigidity, photophobia and other signs of meningeal irritation. It increases in severity with the raising or moving of the head but, unlike the lumbar puncture headache, *it is not appreciably improved by lowering* the head. It is relieved only by an ice cap or drugs or by removal of some of the spinal fluid. The latter shows increased pressure and an increase in cells and globulin content.

Treatment:

(1) Keep the patient flat in bed with an ice cap on his head.

(2) Make frequent lumbar punctures to relieve pressure.

(3) Promote diuresis and catharsis. The best diuretic is 10 per cent intravenous glucose in infusions of 1000 c.c.

(B) *Postoperative Paralysis and Neuritis.* These are rare complications of spinal anesthesia and when they occur they should cause little anxiety as they usually clear up spontaneously. The commonest form of this type of temporary paralysis is that affecting the external recti of the eye which are supplied by the sixth cranial nerve.

(C) *Postoperative Backache.* This is an uncommon but important postoperative

complication that occurs under either general or spinal anesthesia. It is due to the strain thrown upon the lumbar arch by prolonged dorsal decubitus upon the comparatively rigid operating table. Under spinal anesthesia the lumbar muscles being atonic, the strain upon the ligamentous elements in the lumbar arch is greater than under general anesthesia. In the *prevention* of this form of strain a small pillow in the lumbar arch is indicated.

(D) *Postoperative Hiccough.* This is an occasional complication of any postoperative state regardless of anesthesia. It would seem that it is most frequent following prostatectomy under spinal anesthesia.

Treatment consists in 5–10 per cent carbon dioxide and oxygen inhalations.

R. M. Waters[22] uses this treatment in the State of Wisconsin General Hospital with entire satisfaction. He advises the development of a very active hyperpnea for a long enough period to bother the patient slightly, and the repetition of this treatment if the hiccoughs recur. In the event of an unusually severe attack that does not prove amenable to carbon dioxide inhalations and the production of hyperpnea, Waters suggests a moderately heavy dosage of the barbiturates.

SUMMARY

The indications and contraindications for spinal anesthesia have been discussed. The technique of induction, control of anesthesia, novocaine dosage, posture and general conduct of a spinal block have also been briefly indicated. Under the head of the physiology of spinal anesthesia, the recently espounded theory of A. I. Willinsky concerning selective action of novocaine upon the dorsal roots in the subarachnoid space is adopted as the most rational theory, explaining as it does, all of the phenomena of spinal anesthesia. The fall in systolic blood pressure that is a common accompaniment of laparotomies under spinal block is described as a form of shock. The cause of the shock is considered to be anoxemia and the treatment is accordingly increased respiratory activity and if possible, the inhalation of oxygen, preferably through the mask of a gas machine. The postoperative complications of spinal anesthesia are discussed and treatment suggested as indicated.

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OX FASCIA (DEAD FASCIA) GRAFT*

S. THOMAS GLASSER, M.D.

NEW YORK CITY

THE use of ox fascia in surgery is comparatively recent. Clinical and laboratory data have definitely established the usefulness of the dead graft. It is only natural that its use should follow the original work with the living suture. Credit is due to the ingenuity of MacArthur who first used live fascial strips obtained from the external oblique aponeurosis to suture muscle to Poupart's ligament, and to Gallie and LeMesurier who obtained noteworthy results in fascia lata transplants. With these encouraging results as an impetus, the possibilities of an heterograft came into view. To the indefatigable efforts of Nageotte and Sencert[17] we owe the all important fundamental knowledge in this field, namely, the microscopical structure and alterations in the involved tissues. Clinically, Koontz has contributed largely.

Clinical proof is not final concerning the ultimate fate of dead fascial grafts. However with the work of Nageotte and Sencert we have a rationally practical basis. These workers found that preserved fascia did not differ fundamentally from the living graft. Since connective tissue fibers originating from living tissue are inert, it is therefore indistinguishable in its microscopical and architectural arrangement when compared with the dead graft. Koontz[13] clearly states,

> Nageotte's work showed that the dead cells of the graft were removed by the wandering cells of the host; fibroblasts from the host grew into the persisting connective tissue framework of the graft, and repopulated this framework with living cells in the place of the old dead inhabitants; and finally, a new circulation was established in the graft, so that in a short while it was impossible to tell that the graft had ever been dead . . . The fibers of the connective tissues are inert coagula formed from living cells, and that, hence, their preservation in alcohol does not change their physical or chemical character in the slightest. The final results are the same in the use of dead and living fascia—in the former the cells die and are replaced from the host while in living fascia the cells live.

Accepting these partially theoretical observations, we must agree that there could be no foreign body reaction in healing of the grafted tissue. Clinically, this has been debated. Most surgeons believe that there is no foreign body reaction. Opponents of this view are Rosenblatt and Meyers[7] whose experimental work has been worthy of note.

The question of absorbability is of interest not only in the instance of dead suture, but sutures in general. Unquestionably, absorption of any suture material depends to some degree on the condition of the patient and is probably most rapid in a healthy individual. It is slower in the aged, the anemic, and the presence of constitutional disease. In serous or mucous membranes, healing is approximately four times as fast as in muscular tissue. The larger the strand the slower the absorption, this being especially true of the knot. Consequently it is often more practical to use two small strands of suture instead of one large one. Absorbability is apparently a part of a process of digestion and solution, in which formed tissue ferments penetrate the suture. This process is facilitated when finer catgut or smaller knots are used, just as finely powdered solids dissolve more readily in solution than do course particles. It has been aptly quoted that, "It is well that we should recognize that the only permanent suture, if it is ever discovered, is one that is gradually embodied in the living tissues." The absorbability of the common

* From the service of Dr. J. H. Fobes, Director of Surgery, Metropolitan Hospital, New York City.

suture materials is not entirely a closed question. Catgut is acceeded as absorbable as is kangaroo tendon. Hutchinson's observations oppose the general opinion as to the latter suture. The concensus of opinion places dead and living fascia in the "unabsorbable" class. This is also questioned, particularly by Rosenblatt and Myers whose experimental evidence appears as formidable proof that some absorption is present and that there is "a vascularization of the graft and also a foreign body reaction." Their work revealed that after autopsy, the grafts appeared smaller. Haas[5] concluded that "proliferation of the cellular elements of the transplanted fascia at the site of the union with muscle; the muscle cells showed some cellular activity; the endomysium and perimysium appeared to have contributed the greatest amount of tissue response in forming the union." Wolfsohn[11] also believes that there is some absorption of the graft. Experimentally, the dead fascia, being indurated, resists absorption more than does the living fascia. Tests applied twenty-one months after preservation in fluid antiseptics showed the fundamental structure of the fascia to be unchanged.

The value of ox fascia is apparent when one reads the optimistic reports of those who have used it extensively. Elliott[1] states: "its use in patients whose fascia lata is so weak and friable that it will not provide strong sutures and in those patients whose general condition calls for as little manipulation as possible, for example in aged patients and in those with a strangulated hernia. The results in such cases have been gratifying." Elliott has had no infections following the use of ox fascia. He has noticed collections of serum in his cases occurring more frequently than ordinarily after the use of catgut. He attributes this to niches between the sutures forming dead spaces and not to foreign body reaction. Burdick believes that dead and living fascia are equally efficient. When one considers that fascial union, exclusive of grafts, ordinarily requires approximately twenty-one days for firm union, the obvious value of a non-absorbable suture as ox fascia is apparent.

Successful results are obtained by attention to a few details in technique. A preliminary factor essential to good union is the cleansing of the fascia of fat and areolar tissue. Experiments have proved that failure to do this gives poor union. Furthermore, since the fascial suture has a tendency to slip, it is essential that it be anchored with catgut in its course by interrupted occasional sutures. Koontz, Gallie, and LeMesurier have guarded against splitting of the ends of the grafts by the use of transfixation sutures by which the ends are prevented from unraveling. Ordinarily when using catgut for repairs especially in bad herniae, the connective tissue union has a tendency to stretch and weaken under stress. This is not true of the heterograft. Hertzler[22] believes that a fibrinous exudate is essential for firm union of muscle to fascia, this being accomplished by sutures tight enough to traumatize the muscle. Most operators however do not deem the tight suture essential for the reason that when the patient comes out of anesthesia, the wound tension increases.

Only two complications after the use of the dead graft need be mentioned, namely, infection and foreign body reaction. Neither have occurred often enough to be considered as contraindications in the use of ox fascia. The literature leads to the belief that both foreign body reactions and infections are negligible. Burdick[2] has recorded 10 per cent of infection in his cases.

The possibilities for the use of ox fascia are many. It can be applied extensively in orthopedics including types of operations from tendon repairs to joint capsule work and arthroplasty. It has even been used to fill in pleural and dural defects with good results. In the repair of hollow viscera and other organs of the body, ox fascia has been proved efficacious. However its chief use has been in the repair of herniae of all types.

Our experience with the heterograft has been gratifying. We have used the only

suture of its kind made commercially, at the request of Dr. Koontz, which has been on the market only for the past two and a half years. Before that time, Koontz and others had (and they still do) prepare ox fascia for their individual use by preservation of the graft in 70 per cent alcohol. Sufficient time has not yet elapsed for us to determine the fate of the heterograft within the body. The question of absorbability is still problematical although we believe that it is non-absorbable. However, clinically, the results have been excellent. Our collection of cases totals 30, the majority of these include those operated upon by Dr. Fobes. Only two wounds were involved in delayed healing. One developed a jejunal fistula following resection of intestinal adhesions, and in the other, part of the suture sloughed out. However, both patients showed a perfect result when examined six months later in our follow up clinic. The question of foreign body reaction as evidenced by a prolonged serous discharge from the wound has been present in 3 of our cases. Our percentage of infection has been negligible, less than 1 per cent, and we therefore do not consider this as a factor of importance. All cases, six months to two years postoperative, seen in our follow-up clinic were considered cured. Our cases have included umbilical, ventral and inguinal herniae, hepatopexy and closure of upper abdominal wounds where the fascia was weak. In the latter type of case we feel that ox fascia should be used prophylactically. Our technique consists of threading the fascia on a large MacArthur needle and anchoring the graft with fine catgut to reenforce the graft along its course. We have been careful to cleanse the body fascia of fat and areolar tissue. In concluding, we feel that our success with ox fascia is largely due to cleansing of fascia and anchoring of the heterograft. It requires no detailed knowledge of a special technique and the results are excellent.

CONCLUSIONS

1. The great tensile strength and probable non-absorbability of ox fascia makes its use valuable.

2. Its advantage over live fascia is evident since the results are equally good with both.

3. Infections and foreign body reactions are negligible factors.

Note: I am indebted to Dr. J. H. Fobes for his helpful suggestions and cases.

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HOFFA'S DISEASE & EXTERNAL CARTILAGE INJURY IN SAME KNEE

HERBERT E. HIPPS, M.D.

MARLIN, TEXAS

HOFFA'S disease or an inflammatory hyperplasia of the fatty tissues of the knee joint producing joint disability has been recognized and treated since 1904 when A. Hoffa first published his observations on this condition. It is nevertheless somewhat of a rarity, not often diagnosed or treated and relatively few cases have been reported in the literature. Likewise external cartilage injury in the knee joint may be placed in that group of cases that are infrequently seen and seldom diagnosed. Therefore, I think it would be of interest and of some value to report this case in which both pathological conditions were found in the same knee joint.

CASE REPORT

M. D. Aged fifty-eight. April 18, 1931.

Chief Complaint: Pain in right knee.

Present Illness: About six or seven weeks ago the patient was feeding chickens in the back yard when a pig ran between her legs striking the right leg more forcefully than the left and almost throwing her down due to the force of the impact. She immediately felt a sharp pain in the knee joint on the outer aspect and had to limp back to the house. There was no immediate swelling, but the knee continued to hurt so severely that she went to bed. She remained in bed for three or four days during which time the knee swelled somewhat. On the sixth day she got up and began to go about her usual household duties although the knee remained very sore and tender particularly on the outer side. It gradually got better, but never entirely cleared up.

Off and on since then, whenever she uses the knee more than usual it will swell somewhat and become increasingly tender, then she will stay off of it for three or four days and part of the soreness will subside. There remains constantly, however, a dead ache behind the patella and along the outer aspect of the knee along with some tenderness there. There was no history of locking.

FIG. 1. Obesity of patient and postoperative scar on knee.

Examination: Patient was an obese white female of about forty-five or fifty years of age. Temperature was normal. (Fig. 1.)

General examination was essentially negative except for a moderately advanced arteriosclerosis and a mild hypertension.

Examination of the inferior extremities found motion in all joints normal except for slight limitation of extension in the right knee which was also slightly painful on attempting to execute motion. All muscles of both extremities were normal except that there was some weakness in the right quadriceps extensor group. The contour of the right knee differed somewhat from the left in that there was a fulness present on either side of the ligamentum patellae. Measurements:

Right knee 14¼ inches.
Left knee 14½ inches or a swelling of ¼ inch.
Right thigh 16¼ inches.

Fig. 2. Entire group of tags and cartilage removed; cartilage in center and another piece on right. Note fat tag lower center, very fibrotic. It measured 3 cm. in length at removal.

Left thigh 15¾ inches or an atrophy of ½ inch.
Right calf 14½ inches.
Left calf 13¾ inches or an atrophy of ¾ inch.

There was more medial mobility of the leg on the thigh than lateral, indicating external lateral ligament laxity. Anterior and posterior cruciates were normal. There was no tenderness on pressure over internal lateral ligament or over the anterior end of the internal meniscus. There was, however, tenderness over the external lateral ligament at the level of the joint and slight tenderness over the anterior end of the external cartilage. There was a diffuse vague tenderness present over the anterior surface of the joint, but most marked on either side of the patella.

X-ray, anteroposterior and lateral, of the knee failed to show pathological changes.

Diagnosis: Hoffa's disease, right knee joint.

Treatment: The patient was advised to go home and have her home doctor put on a plaster cast with the knee in almost complete extension to completely immobilize the joint so that the synovitis and swollen fat tags could subside; this to be followed in two weeks by graduated movements and development of the strength of the quadriceps muscles along with massage, hot and cold contrast baths, etc.

The patient went home but did not follow instructions and returned to me August 29, 1931 with the same complaint. This time I advised operation to which the patient consented.

Under spinal anesthesia an incision was made vertically external to the patella, the knee joint entered and several fatty tags and the external cartilage removed. A plaster cast was applied with the knee in complete extension. This was removed on the tenth day, the stitches removed and gradual movements instituted. Weight bearing was allowed in four more days. Quadriceps exercises and physical-therapy were instituted.

Follow-up Record: She was seen at two-week intervals following dismissal from the hospital, during which time she rapidly gained strength in the knee and at no time felt any pain in the knee after the operation.

The patient was last seen February 16, 1932 or five months after the operation at which time she was completely free from knee discomfort and was going about her duties as usual, perfectly satisfied. There was no tenderness anywhere about the joint, no limitation of motion and no undue laxity of the ligaments.

Gross Pathology: On opening the synovial sheath there were found on each side of the femur prolongations of the fatty mass behind the ligamentum patellae. Behind and to either side of the patella also were large fatty tags

protruding into the joint. On extending the opened joint these could be seen to become pinched between the articular surfaces. The

Fig. 3. View of inner edge of external cartilage showing split margin. Left end is anterior.

fatty tissue about its periphery was slightly swollen and hemorrhagic and was penetrated irregularly by fibrous strands very different in appearance and consistency from the bases of the tags. (Figs. 2 and 5.) Other smaller fatty tags hung from the synovial surface at intervals, but most marked about the folds around the cruciate ligament. The synovial membrane was thin and tore very easily.

The external cartilage was seen to be split horizontally at its middle and the upper edge of the split surface seemed to be curled up on itself. Small cartilage bits were loosely attached about the fragmented edges. (Figs. 2, 3, and 4.)

Microscopic Pathology: Three sections were made, one from the swollen fibrous periphery of the impinged tag, another from the base of this tag and another from a smaller tag including part of the synovial membrane.

The section from the tip of the tag showed a mass of fatty tissues through which was irregularly woven at close intervals parallel strands of wavy fibrillar connective tissue. About the meshes of the fatty strands and connective tissue strands, engorged blood vessels were relatively numerous and around some were red cells in large numbers. Occasionally small clumps of lymphoid cells and plasma cells were scattered about throughout the mass. There were other smaller areas of focal fibrosis, mere fibrotic stellate areas surrounded by a few lymphoid cells.

The section from the base of the tag showed a fatty mass with thin fibrous meshes, relatively widely spaced and in the interspaces relatively few blood vessels were seen. Only occasionally could a lymphoid cell be found. All fat cells were normal in appearance and there was no excess amount of fibrous tissue anywhere visible.

The section from the smaller tag showed approximately the same picture as the second section except that the synovial membrane

Fig. 4. Cartilage sectioned transversely through split area. Note rolled under edge forming a rounded mass resembling a cartilage cyst. A very unusual type of cartilage injury.

showed a few fatty globules in it at irregular intervals and there were not so many blood vessels as was present in the preceding section.

Fig. 5. One fatty tag. Note that end of tag on right is smooth while edge at top is irregular and fibrotic where it has been pinched between articular surfaces.

DISCUSSION

It was once believed that this hyperplasia of the fatty tissues of the knee joint was of tuberculous origin until it was disproved by Schuchardt. A. Hoffa published his work in 1904 and proved rather definitely that it was purely traumatic in origin, occurring chiefly in older people and those having a tendency toward obesity and a rheumatic diathesis.

(Fig. 1.) He showed that it was an inflammatory fibrous hyperplasia of the fatty tags of the joint which originated in a person who is overweight and in whose joint the tags have grown to a larger size than is normally present. Due to some injury or strain to the knee one or more of these enlarged tags would be pinched between the articular surfaces causing it to swell and become painful. As a result of the swelling it would be pinched again and once again it would swell producing a vicious cycle.

External cartilage injury is not often seen, while internal cartilage injury is very frequent. The mechanism of internal cartilage injury results from a force direction from outward inward toward the joint while external cartilage injury is produced by a mechanism directly opposite to this. It was just such an injury that this patient received which in all probability resulted in the onset of both pathological conditions.

In the early stages of Hoffa's disease, it may be cured by immobilization and physiotherapy while after it has progressed to where definite fibrosis has occurred, operative intervention offers the only probability of relief.

External cartilage as well as internal cartilage injuries may be cured by immobilization following manipulative reduction if seen early enough, but here again, after the lapse of a period of time operative removal of the offending part is the only hope of cure.

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THE CRIPPLE

OFTEN A NEEDLESS LIABILITY

WALTER TRUSLOW, M.D., F.A.C.S.

BROOKLYN, N. Y.

IN this mechanistic age, it is pertinent to consider the efficiency of the human machine. Is crippling of the joint and skeleton mechanism necessary? Must the child who has been born with a distorted foot or a dislocated hip be handicapped for life? Shall such diseases as rickets, tuberculosis, poliomyelitis and chronic arthritis leave in their trail so many bone and joint deformities and disabilities as still prevail? Must the factory and automobile accidents eventuate in as much crippling as is found? Shall the individual, the family, the community continue to carry the load of the all too prevalent cripple? It is because the writer believes that much existing crippling is unnecessary that he attempts to point the way to lessening it.

The causes of crippling may be grouped as (*a*) *congenital*, (*b*) *the result of disease*, (*c*) *the result of accident and injury and* (*d*) *a class which gradually develops deformity from certain occupations, faulty postures and from excessive weight.* Science, biological or medical, gives us as yet no way to prevent the deformities due to *prenatal* conditions. Indeed, what these conditions are is but little known. That certain deformities seem to be inheritable and that marked discrepancy in the ages of parents seems to tend toward deformity are but suggestive observations. Rickets, tuberculosis, poliomyelitis and chronic arthritis are the most common *diseases* which tend to cause disability and skeleton deformity. Factory *injuries*, railroad, automobile and now aeroplane accidents and gunshot and other fight and war injuries are well known. The campaign for "Safety first" in industry and in travel is tending to lessen the injuries and prompter and better surgical care is lessening the disability resulting from accidents. The bent-over sitting positions of the student or clerk, some habitual faulty standing positions, the prolonged maintenance of habitual postures of hands and feet predispose to such deformities as round back and shoulders, curvature of the spine, flat-feet, writer's and artificer's cramp, and low back pain.

All of these conditions either present immediate deformity, as in the congenital cases and in some of the accident factors, or tend toward the gradual acquiring of deformity, by virtue of intrinsic principles connected with them. In all therefore the tendency to crippling must be considered. Can crippling be prevented? Temporary disability is present in all. It depends largely upon the way in which the temporary disability is cared for as to whether it is to become permanent disability, deformity, crippling. The details of this care fill large textbooks on orthopedic and reconstructive surgery and cannot be included within the scope of this paper. It is in order however briefly to discuss some of the principles of this care.

A *congenital club-foot* should be treated from about the second week after birth, although cure may usually be obtained, without operation, even if begun later. About three months of light plaster-of-Paris dressings will usually overcome the visible signs of the deformity. Then, until the child walks, some simple retention apparatus with daily carefully taught manipulation, by the mother or nurse, will further lessen the imbalance of opposing muscles. Oversight by the physician during the second year, the first walking year, with outflanged shoes, is necessary to complete the important reestablishment of muscle

balance. Failure to carry through until muscle balance is restored is the cause of incomplete cure. A set deformity, with badly resistant contracted muscles and ligaments, may often be corrected, up to about the third year, by vigorous stretching and over-stretching manipulation under an anesthetic and plaster-of-Paris retention. But even more do these cases require thorough after-care to attain rebalance of muscle forces. All too soon is the factor of distortion of bone shapes added to that of muscle and ligament contraction. When this degree of deformity is reached, it is useless to attempt the correction of the deformity without operation. A bone reconstruction operation, not mere tenotomies, is necessary and when thoroughly done gives excellent results, even in adults. Crippling should never be necessary in club-foot, whether congenital or paralytic.

Congenital dislocation of the hip is a harder problem. If we could train physicians and the community, as is now being done in Italy and as Jaeger (N. Y.) advocates, to detect and begin the care of congenital hip dislocation in the first few months of infancy, this deformity could be included among the unnecessary causes of crippling. This early treatment is by apparatus, without anesthetic, takes but four to six months and results in a high percentage of complete cures. The practice in this country has been to wait until the child is "weaned" from the diaper and then by manipulation under an anesthetic (Davis' or Lorenz's methods) to stretch resisting muscles and ligaments, warp the femoral head into its socket and hold it there, with plaster-of-Paris, in the "frog position." By this method, successive plaster-of-Paris dressings, carried over a period of about one year, gradually bring the thigh back to the neutral position. The results have been a little over 50 per cent of cures. The method is used up to about seven years of age in single dislocation; to about five years of age in double dislocation. Open operation, now increasingly advocated in childhood and adolescence, has increased the percentage of cures. As yet, complete cure, that is placing and retaining the femoral head in its socket, is but rarely attainable in adults, even by open operation. So, until an educated public is keen to detect the cases very early, we must place congenital dislocation of the hip in the group in which the deformity is not always correctable; and he who has uncorrected hip dislocation is indeed a cripple. As a profession, we should include examination for this in young infants. The baby, stripped and lying on his back with legs extended, shows some degree of shortening on the side of an affected hip. Double dislocation would not show shortening, but a prominent and high position of the femoral trochanters can be felt and sometimes seen. Either of these conditions should lead to an *x*-ray study of the child's pelvis and hips. But the case of the adult with uncorrected dislocation of hip or hips is far from hopeless. The great disability and pain which is due to stretching of unstabilized muscles, is much mitigated by the shelf operation. This consists in building a bony roof on the side of the pelvis and necessarily above the acetabulum. When the new bone is well organized, the femoral head has a solid weight-bearing support for itself, and pain ceases and mechanical efficiency is enhanced. This operation successfully performed brings happiness and economic and social efficiency to one who decidedly lacked these. These erstwhile cripples are no longer individual and social liabilities.

The details of the deformities resulting from rickets and from tuberculosis cannot be given here. They consist in the conservation of the bone and joint parts by bracing to prevent deformity and the correction or compensating of uncorrected deformity by operation. Uncorrected, the *rachitic* bowlegs, knock knees and coxae varae are decidedly crippling conditions. Most of the deformities may be prevented by proper bracing and by dietetic care of the rickets. Practically all may be cured by operation. Rickets should not cause per-

manent disability. The rachitic cripple should not exist.

Bone and joint tuberculosis does not give so favorable an outlook for the elimination of crippling. Still deformities should be prevented; protection should be carried through for many months and even years. There is an increasing tendency today, among orthopedic surgeons, to lessen the time element in the protective care, of joint tuberculosis, by frankly eliminating the joint function by operative fusion. By this means the care of the tuberculous spine, hip, knee, elbow or ankle is cut down from perhaps six years to six months. The result is cure of the disease, in most cases, with crippling greatly reduced; and a social liability is turned into a social asset.

When we come to *poliomyelitis* we discuss a disease that kills (10 to even 25 per cent in some epidemics), that permits recovery without paralysis and so without deformity (an appreciable number in the 1931 epidemic) or, as in the majority of cases, that results in localized paralysis and thus in a marked tendency to deformity. It is of course only with the large middle group that this paper will deal. The principles of deformity development, its causation by unequal return of muscle power and by gravity pulls are becoming better understood by the profession and by the laity. The need of deformity prevention by prolonged but gradually lessening protection by bracing, of aiding Nature's return of muscle function, by increasing muscle re-education, and finally of effective compensation for apparently permanent disability by operation, has been preached by the orthopedic surgeons for years. Still there is altogether too much pessimism concerning infantile paralysis. Discussing poliomyelitis from the standpoint of our title, we may say that (a) the disease tends toward deformity, (b) that deformity is due largely to unequal muscle balance, often aided by faulty gravity pulls, (c) that deformity can and should be prevented and finally (d) that inevitable apparent permanent disability can be greatly lessened by the thoughtfully planned and skillfully performed reconstruction operation. The paralytic victim should be much less of an individual and social liability than at present.

Chronic arthritis as a crippling problem is a difficult one. It is a constitutional disease and should be treated as such. Yet, after some weeks or months or even years, a certain proportion of them seem to have had the toxic element eliminated. If this happens before serious damage is done to the joint structure, the patient is not crippled. This is unfortunately not the usual outcome. More frequently articular cartilage is destroyed and joint surfaces are eroded or present nodular outgrowths, all of which interfere with good joint action, and keep up local inflammation and pain by friction. All cases of chronic arthritis should be considered as potential deformity cases. The physician in charge, who is caring for the constitutional condition, who is endeavoring to eliminate the general toxemia, should see to it himself or by professional reference of the patient, that deformities are prevented. The means of doing this are usually also pain-relieving means. Fortunately some cases seem to arrive at a stage when the toxic elements may be said to be eliminated, but with much damaged joint or joints. When this is patent, the orthopedic surgeon should be given the opportunity to determine what repair is possible. Many physicians are scarcely aware that much repair is possible to these damaged joints. A knee, for instance, which has been damaged by arthritic changes, but where there is evidence of the elimination of the constitutional toxemia, may be given good function by arthroplasty, an operation to restore motion by the clearing away of detritus and friction-causing joint nodules and by inserting living autogenous membrane over the articulating bone ends. We may evaluate chronic arthritis as a real crippling liability, but to a lesser extent than prevails today. The greater problem is the elimination of the systemic poison.

Many of the deformities and disabilities resulting from badly set *fractures*, and which come late to the orthopedic surgeon, would not be cripple liabilities if original setting of the fractures had been more carefully controlled by anesthetic and *x*-ray check-up and if retention of position and early guarded motion were better practiced. Today we are not satisfied with mere bony union. We look to good function, which can be attained only by exact apposition of fracture segments. Even compound fractures are more amenable to exact apposition of fragments than is generally supposed. Fracture work should result in less crippling liability than is found. Fortunately in this field of surgery reconstruction operation may transform the liability of old poorly set fractures into satisfactory assets. The present writer would plea for better initial work on fractures.

Of the many *occupational* and *static deformities*, this paper will discuss only *flat-foot*. None but the sufferer from flat feet can realize the handicap he labors under; how much of a cripple he becomes. He is included in the group of needless liability because so many individuals go around with unnecessary suffering, doing nothing or taking useless medicine or hunting for but seldom guilty foci of infection. Flat-foot is in nine cases out of ten a local mechanical disability and not a constitutional one. The correct treatment is to relieve the strains by proper mechanical support and gradually to train the natural supports, the mucles, to take back the job which artificial supports must first perform. The flat footed person is a decided cripple; he is usually a needless cripple.

Such are some of the technical reasons why the orthopedic surgeon considers much of current crippling unnecessary. Others have discussed the sociological liability of crippling, the individual inferiority complex, the relatively great difficulty in getting employment, the real handicap in pleasures and in employment as well as the financial burden on the family and the community to care for cripples. We would also emphasize the sense of discouragement and of the futility of continuing a course of treatment, which has not seemed efficient to the patient and his relatives and friends, as an all too common cause of needless crippling. Is not this last an arraignment of the medical profession? Granting that the main arguments of this paper are true, do we of the profession give as much thought to the causes and prevention of crippling as we should? From observation of many cases he has seen of needless crippling, the writer believes this to be the case. Of course, from our point of view, the patient is also to blame in going from one poorly equipped "healer" to another who guarantees cure! Some persons will never understand why conscientious physicians will not guarantee cures. People get guarantees on their vacuum cleaners, on their radios, why not from the doctor! The patient is to blame also in going, without prescription, to brace makers, who, understanding little or nothing about the nature of the disability or deformity, will make a brace which has inadequate effect upon the condition presented. The futility of combating a "curse of God" upon a cripple is a more frequent cause of avoiding the treatment of crippling than may be supposed. "Against ignorance the gods themselves fight in vain." But we doctors have seen most of these patients at one time or another. Has our guidance of them been such that they should know the inefficacy of heeding untrained promises or of taking highly technical problems into their own hands. And lastly much has been said, in this paper, of bracing and of reconstructive operation. Of course, we all know the average person's dread of both of these procedures. This paper is therefore also a plea for a more sympathetic approach, on our part, to these questions and a greater confidence in the efficacy of treatment, that we may the better inspire our patients with the same confidence.

[Concluded on p. 557.]

NEW INSTRUMENTS

AN IMPROVISED COCK-UP SPLINT

JESSE B. GRIFFITH, M.D.

PITTSBURGH, PA.

A SIMPLE and quite satisfactory cock-up splint for the wrist can be quickly made from a bandage, a piece of wood and some adhesive.

A piece of ordinary stiff splint wood, 2 inches wide and of proper length for the individual, is used. A long strip of 2 inch adhesive plaster is wrapped one and one-half times around the circumference of a 2 inch gauze roller bandage. The bandage is placed horizontally across the splint near one end, and the adhesive is continued down over the end of the splint, backward along its under surface, upward over the posterior end, forward along the upper surface going up over the bandage and continuing some distance back on the under surface. A 2 inch strip of adhesive is wrapped once around the splint just back of the bandage to bind the layers together and the splint is ready for use. The accompanying diagram (Fig. 1) will make evident the method of construction.

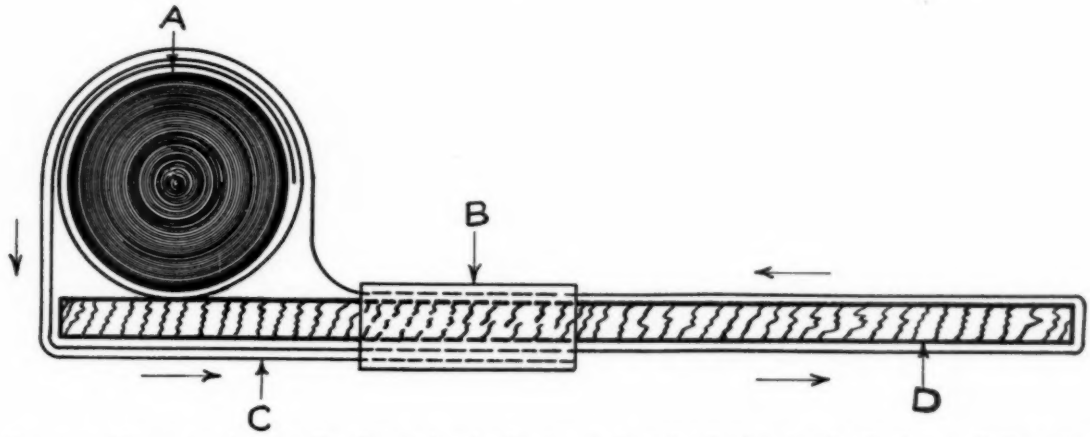


FIG. 1. A, Gauze bandage. B, Binding strip of adhesive. C, Longitudinal strip of adhesive. D, Splint wood.

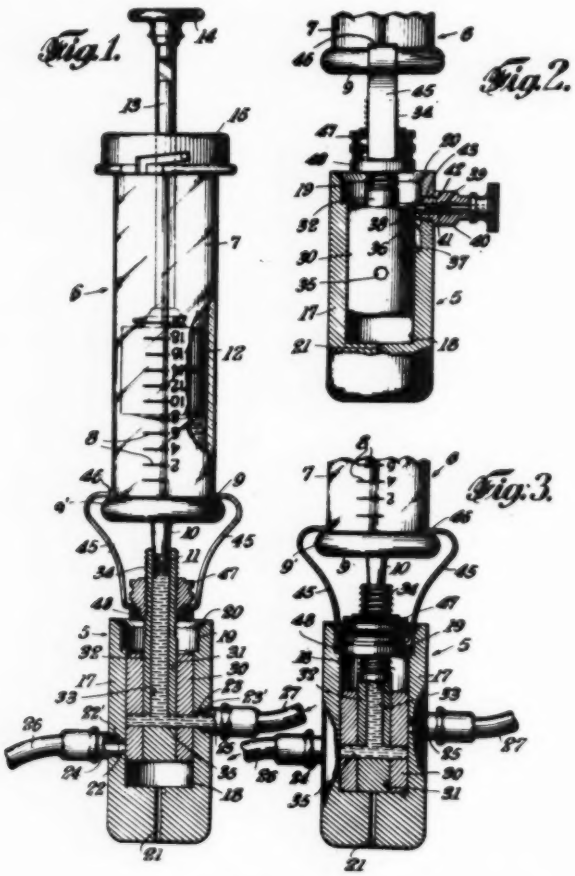
Most of the injuries of the forearm, wrist and metacarpals that require splinting are best treated with the wrist in dorsiflexion and a readily available cock-up splint should make treatment in this position more frequent.

TRANSFUSION APPARATUS*

VICTOR CARABBA, M.D.

NEW YORK CITY

SINCE the introduction of blood transfusion as a therapeutic measure in medicine innumerable types of transfusion devices have been developed. The majority have proved either impractical, too complicated or too expensive and as a result have fallen into discard. As a result of this the medical profession rightfully has questioned the introduction of new devices of this type. With these past experiences in mind it is with trepidation the device to be described is presented.



FIGS. 1–3.

The simplicity of construction, the inexpensiveness, the ease and safety of operation, its durability and its construction which lends itself to easy cleansing and sterilization have promoted its presentation to the medical profession.

The embodiment (Fig. 1), as at present preferred, includes a cylindrical casing or barrel member (17), constructed of suitable metal and having an aperture (18) extending from its upper surface through substantially three-fourths of its length. The aperture is desirably provided with an enlarged portion (19) at its upper end, the upper edge of the body member having an inwardly bevelled portion (20). The lower end of the casing is provided with a small longitudinal aperture (21) for a purpose to be described later.

Two transverse apertures (22 and 23) are made in the casing member directly opposite each other, the former aperture, in the present embodiment, being substantially ¼ inch below the latter. The apertures are provided with enlarged threaded portions (22′ and 23′) adjacent to the outer surface of the casing, nipples (24 and 25) being engaged in the enlarged threaded portions, the nipples carrying suitable rubber tubes (26 and 27), hereafter described as the outlet and intake tubes, respectively, these tubes leading to the needles (not illustrated) which are inserted in the veins of the recipient and donor respectively.

A valve member or plunger (30) is accurately fitted within the aperture (18) in the casing (17) and is adapted for longitudinal reciprocating movement. The valve member or plunger is provided with a longitudinal aperture (31) throughout the length, a nipple (32) being secured within this aperture. The nipple is preferably made from a solid piece of round material and has a longitudinal aperture (33) drilled

* From the Third Surgical Division, Bellevue Hospital, N. Y.

from its upper terminus through slightly over three-fourths of its length, the upper portion of the nipple having external threads (34). A transverse aperture (35) is drilled through the center of the valve member and through the nipple, the longitudinal aperture (33) in the valve member terminating at the point where the transverse aperture passes through.

The valve member is prevented from rotative movement by means of a stop pin (36, Fig. 2) secured at the upper end, the stop pin passing into a longitudinal slot (37) on the inner surface (18) of the casing (17). The upward movement of the valve member is limited by means of a thumb-screw (38) having a threaded portion (39) and being mounted in a supporting plug (40) having a threaded longitudinal aperture (41). The supporting plug is provided with a reduced threaded portion (42) at the inner end which is engaged in a threaded aperture (43) in the casing adjacent to the slot (37).

Thus, when the valve member is drawn upwards, as described later, to the point where the transverse aperture (35) is aligned with the aperture (23) in the casing, further upward movement is arrested by the stop pin (36) engaging the inner terminus of the thumb screw (38). When the valve member is forced downwards to the lower end of the longitudinal aperture (18) in the casing the transverse aperture (35) is aligned with the lower aperture (22) in the casing. Inasmuch as the valve member is fitted very snugly within the aperture (18) in the casing, the hole (21) at the lower end is provided in order to allow the air within the lower end of the chamber to pass out in the valve member readily when the valve member is moved downwards.

The following means are employed for securing the syringe in firm engagement with the nipple (32) on the valve member. A U-shaped, spring metal clamp (45), having inwardly turned upper end portions (46), is pivotally carried by a circular internally threaded nut (47) having a threaded collar (48) at its lower end to engage the lower surface of the clamp.

Fig. 4. Operation of instrument: intake or aspiration stroke. See Figure 1.

Fig. 5. Operation of instrument: output or emptying stroke. See Figure 3.

The valve member, as described before, fits snugly within the casing, although not so tightly as to impair the very easy sliding

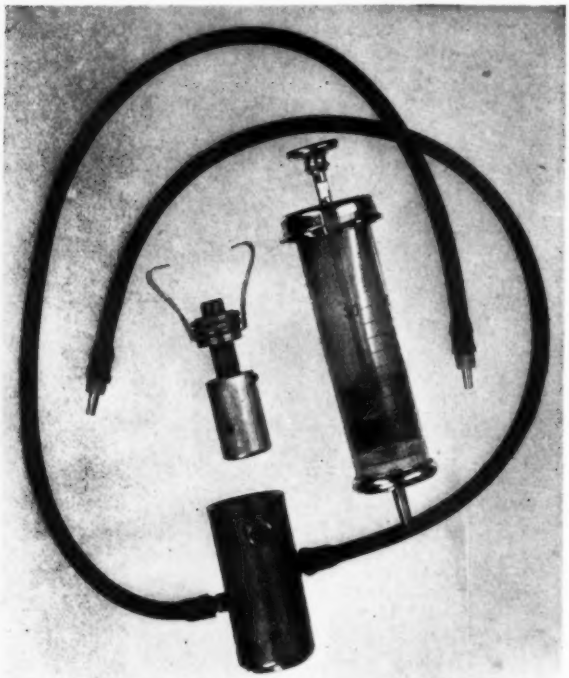


Fig. 6. Parts of instrument, showing simplicity of construction, ease of operation and cleansing.

movement. When the handle (14) or the piston rod (13) of the syringe is drawn outwards to fill the syringe, this outward movement first draws the valve member to the position shown in Figure 1 (the cross channel, 35, is adjacent the inlet port or aperture, 23) by virtue of the fact that the valve member slides far more easily than does the piston in the syringe. In other words, the initial outward movement of the handle (14) does not change the position of the piston in relation to the syringe, but rather draws the entire syringe, to which the valve member is secured, outward, thereby closing the outlet port or aperture to the syringe, and opening the inlet aperture, without special effort, thought or concern on the part of the operator.

Likewise, when the syringe is filled and the piston is forced inwards to expel the fluid, the initial movement of the handle causes the piston to move forwards to the position shown in Figure 3, wherein the cross channel (35) is adjacent to the outlet port or aperture (22). It will be seen that no special effort is required to manipulate this novel two-way valve structure, apart from the normal manipulation of the syringe.

It will be appreciated that the instrument may be readily sterilized by first releasing the thumb screw and removing the valve member or plunger from the casing and then placing the parts within the steam or hot water. The instrument may then be placed in a sterile packet and kept in readiness for use.

When the device is to be used for a transfusion the valve member (30) is introduced into the casing (17) and the thumb screw tightened. The nozzle (10) of the syringe is placed in the upper end of the nipple (32) and the spring clamp which engages the flange on the head of the syringe is tightened securely.

The rubber tube (26) connected with the outlet nipple (25) is placed in a container of sterile normal saline solution. The casing is then held in one hand in a manner that the syringe and plunger of the instrument are not touched by the hand holding the casing. The handle on the piston of the syringe is then grasped with the other hand and operated as the usual hypodermic syringe. On the upstroke of the piston in the syringe the sliding valve member of the device automatically connects with the intake tube and saline solution is introduced into the syringe. On the down stroke of the piston in the syringe the valve member moves forward, thereby closing the passage into the intake tube and aligning the transverse aperture (35) with the outlet tube. In this fashion the entire system (instrument and tube) is filled with saline solution and all of the air expelled. Holding the casing upwards makes for the more rapid expulsion of the air.

Once the system is filled with saline solution the rubber tubing secured to the intake nipple is connected with the needle in the vein of the donor and the tubing

secured to the outlet nipple is connected with the needle in the vein of the recipient and the syringe operated as already described.

The operation will invariably go on smoothly unless the needle in the veins become disengaged or plugged or unless the syringe becomes "sticky," which sometimes results when the piston is slightly worn. In this event, the tubing is disengaged from the veins of the donor and recipient and the apparatus washed in saline solution or a clean syringe substituted. It is advisable in this connection to have a second complete apparatus in reserve to take care of such occurrences, however infrequent, in order that the transfusion may be unbroken.

The same technique may be employed in autotransfusion and in the infusion of intravenous solutions. For aspiration of the chest, peritoneal or joint cavities the apparatus is operated as an ordinary hypodermic syringe.[1]

[1] Demonstrated before Clinical Conference of New York Surgical Society, 1932. Patents applied for by New York University.

CONCLUSION OF DR. TRUSLOW'S ARTICLE*

SUMMARY

Some congenital defects, certain diseases, injuries from accident and postural and occupational factors tend toward deformity. Most deformity and much existing disability is needless. Prevention of deformity and scientific reconstruction for existing deformity is greatly needed. Costs, better distributed in prevention and treatment would be far less than present totals for the maintenance of permanent cripples. The physician should sympathetically but authoritatively guide the cripple and his friends away from the inadequately equipped cure-all; he may be more optimistic with the potential or the actual cripple; he should point the way to adequate preventive and reconstructive treatment. The cripple is, in great measure, a needless liability.

*Continued from p. 552.

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The American Journal of Surgery is truly independent and enters into no "entangling alliances." It publishes many papers read before the leading surgical societies of the Country, but it is *not* "the official organ" of any organization. Every manuscript is selected by the editors as worthy of publication—nothing is published merely because "it was read at the meeting."

EDITORIALS

THE SOUTHERN SURGICAL ASSOCIATION AND THE AMERICAN JOURNAL OF SURGERY

IN these days of retrenchment, it is pleasant to be able to announce a "plus" for our readers. The May and June issues of THE AMERICAN JOURNAL OF SURGERY will be special numbers devoted to papers read before The Southern Surgical Association at its meeting in Miami, December, 1932. These numbers will be similar to the popular Matas Birthday Volume (October, 1931) and we believe will furnish a real chirurgico-literary feast for our readers.

The Southern Surgical Association (founded 1887) has on its roster many of our leading surgeons and ranks as one of the foremost surgical societies of America, if not of the world. THE AMERICAN JOURNAL OF SURGERY is proud to have been selected by this Association for the publication of the papers read at its annual meetings.

The well-known Secretary of the Association, Dr. Robert L. Payne, of Norfolk, Virginia, has graciously joined our Editorial Board and will serve as Associate Editor for these numbers.

In arranging for the publication of these papers, we are not deviating from the "declaration of independence" which has for years headed our editorial page. A

perusal of past programs is sufficient evidence of the fact that the material presented at the annual conclaves of The Southern Surgical Association is more than worthwhile. We can definitely reassure our subscribers that "nothing will be published *merely* because it was read at the meeting."

It is felt that both The Journal and its subscribers are to be congratulated upon this affiliation and the acquisition of this material. In welcoming The Southern Surgical Association to our pages, we dare express the hope that the arrangement so pleasantly inaugurated may prove of lasting benefit to all concerned.

CHEMICALS VERSUS THE SCALPEL

DOCTORS Cutler and Zollinger, in this issue, have re-emphasized one of the oldest of surgical remedies, i.e., the use of chemical solutions. These authors bring evidence to show that sclerosing solutions may well supplant the knife in certain difficult procedures, such as the attempt to remove the lining of thin-walled cysts, as occurs with cervical fistulae, and in relation to brain tumors. This paper also serves to emphasize other technical procedures in which chemicals are used for therapeutic reasons, such as in the attempts to obliterate veins in cases with varicosities.

Such modern suggestions exemplify the refinements of technical procedures and emphasize the individuality of therapy. It is apparent that there is always an attempt to find the most suitable remedy for each condition irrespective of existing methods and whether they be satisfactory or no. Such an attitude is good in more ways than one. Certainly it is best for the sick patient, but also it will eventually have a great influence on medical practice. For with the persistence and elaboration of such a viewpoint will come a newer form of specialization. The method of treatment will no longer be a dividing line in the creation of specialties, for in any given field there may be many different forms of therapy. Should this occur, we can expect a liberalization of treatment, operations by the knife may be reduced, and the surgeon's attitude towards disease will be broadened.

In the article "The Use of Sclerosing Solutions in the Treatment of Cysts and Fistulae" the authors intimate the antiquity of their method, but then report carefully planned experiments resulting in the selection of the most suitable fluid for the particular conditions in which they are interested. Finally they present practical examples in which the use of their sclerosing fluid (i.e., absolute alcohol, 6 c.c., chloroform, 3 c.c., glacial acetic acid, 1 c.c., and ferric chloride 1 gram) has proven most satisfactory. It is an example of the type of problem and its study which so often arises in teaching clinics.

T. S. W.

Subscribers to The American Journal of Surgery *visiting New York City are invited to make the office of the publishers (Paul B. Hoeber, Inc., 76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

CORRESPONDENCE

To the Editor:

Those engaged in pharmacy feel that the indiscriminate use of the word "drug" where "narcotic" or "dope" should be used is a reflection on an honorable business and profession and tends to degrade it in the minds of many lay readers. As defined in the National Food and Drugs Act, a drug is an article used for the purpose of curing, mitigating, or preventing disease in man or other animals.

News writers and headline writers frequently refer to "drug" addicts, "drug" fiends, and "drug" raids when they mean narcotic (or "dope") addicts, narcotic fiends, and narcotic raids.

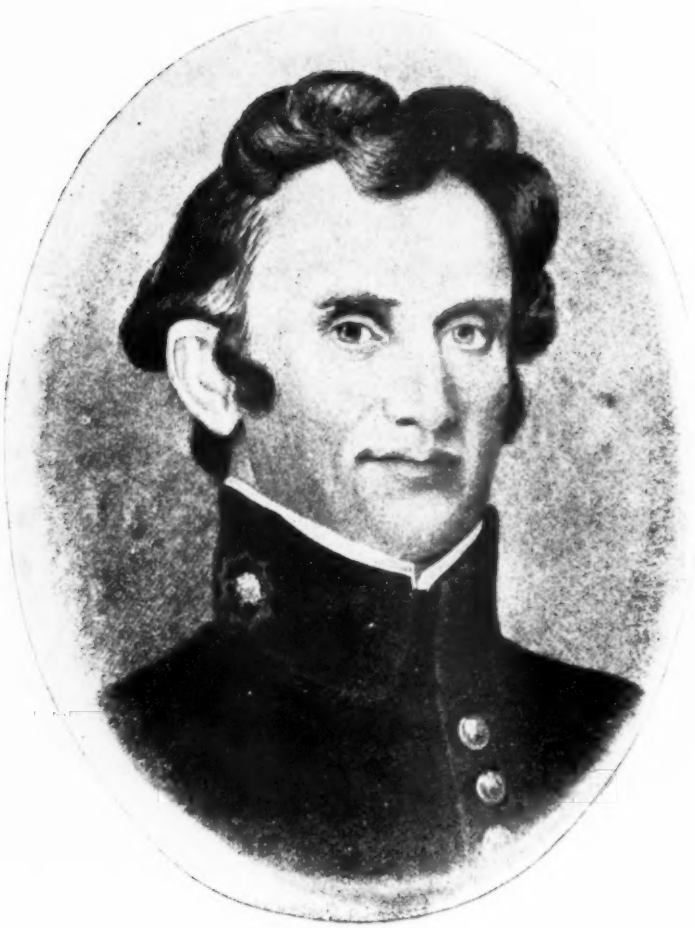
There is no objection on the part of the pharmaceutical profession and the drug trade to the publication of the misdeeds or misadventures of "dope peddlers" or "dope addicts," but to describe them as "drug peddlers" or "drug addicts" does an injury, so they are asking help to discontinue the practice.

The practice is widespread in medical and pharmaceutical literature. Nearly everyone having to do with such publications has been guilty of this misuse of the word "drug," even those seeking a discontinuance of the abuse.

We agree with drug trade officials that this should receive earnest consideration.

JOHN S. WRIGHT

Indianapolis, Ind.



WILLIAM BEAUMONT

[1785-1853]

AMERICAN PHYSICIANS

WILLIAM BEAUMONT

WILLIAM BEAUMONT was the first to study the action of digestion through a permanent fistula in a human being. This study occupied most of his lifetime and secured for him a permanent place in the annals of medical history.

He was born at Lebanon, Conn., on November 21, 1785. He taught school and at his majority began the study of medicine with Dr. Seth Pomeroy of Champlain, N. Y., and continued his studies with Dr. Benjamin Chandler of St. Albans, Vermont. He secured a license to practice from the Third Medical Society of Vermont.

On December 2, 1812, he enlisted as a surgeon's mate in the 16th Regiment Infantry, U. S. A. He saw active service and exhibited bravery under fire. In 1815 he resigned his commission and entered private practice at Plattsburg, N. Y., but re-entered the army four years later and was assigned to Mackinac Island, Mich.

On June 6, 1822 occurred the incident that made medical history. Alexis St. Martin experienced an accident which Beaumont described as a wound "being under the left breast made by the accidental discharge of a shot gun at about two feet. A large portion of the side was blown off, ribs fractured and openings made into the pleural cavity and the abdomen, through which protruded portions of the lungs and stomach, much lacerated and burnt. The diaphragm was lacerated and a perforation made directly into the cavity of the stomach through which food was escaping when first seen." For years St. Martin was a helpless invalid. The civil authorities refused to provide for his needs longer and Beaumont took him into his family and cared for him. A permanent fistula of the stomach resulted and through this Beaumont conducted experiments and observed the action of the gastric juice during digestion.

Beaumont was transferred to different posts and one time, after St. Martin had been lost to view for some time, he discovered his quary in Lower Canada, two thousand miles away, and made provision for his return to his family and a furtherance of Beaumont's own studies. These he first communicated to the Michigan Medical Society of which at a later date he became an honorary member. This Society in 1900 erected a stone monument near the spot where these studies were begun. The experiments were carried on at Plattsburg, Washington, D. C., and St. Louis, Mo. When Beaumont was ordered to Florida he resigned from the army and engaged in private practice in St. Louis. Finally St. Martin separated from Beaumont and became debauched and unreliable.

Since the publication of Beaumont's observations his conclusions have suffered little with the passing of time. In 1833 the Columbia University of Washington, D. C., gave him the degree of M.D., *honoris causa*. In 1837 he was appointed professor of surgery in the medical department of St. Louis University.

He died, the result of an accident, in St. Louis, April 25, 1853.

T. S. W.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

ULRICH VON HUTTEN

BEN WOLEPOR, M.D.

MONTREAL, CAN.

PART III, CONCLUSION*

IV. THE REFORMATION AND ART

All art is the expression of fulfilment, of escape; of a flight from reality, a delving into a hospitable world where unadaptible realities are banished; a world of Beethoven harmonies where events are logical and presided over by the masterly intellect, and the conglomeration of various discordant cries, beating upon the reluctant air with no rhyme or reason is excluded. In music the end justifies the beginning and the substance fulfills the destiny of the creator, whereas in life only rarely is the ideal existence obtainable. In Art, man makes even of the dismal spectacle of tragedy a humanizing uplifting view; for Art is a dream world made visible and articulate; once more is a city built between the Tigris and Euphrates and called Eden. At a cursory glance, the solid and abiding work of Bach maybe called the bed-rock, the basic stratum whereon rests our musical world of the present. To hear Casal's interpretation of his Chaconne is a revelation; images rapidly follow one another and the prevailing impression is that of an enclosed ocean, surmounted by a vault bearing down upon the sea of sound and majestic harmony. There is a loss of personality in this overwhelming reality, an acquisition of an abiding peace, the feeling of a conqueror who need no longer strive, the serenity that is a birthright and not an inheritance, and an overflowing grandeur uplifting in its simplicity. All this was not evolved over night. True that a great spirit breathed into these works as God did upon the face of the waters, but the spirit required substance to work upon. In the Flemish fuguists and their predecessors, the Canon writers of the Gotho-Belgic schools, and earlier, and the Parisian developers of the counterpoint originating in French Flanders during the tenth century, we discover the strata underlying and upholding the passion music, the sacred cantatas, and the instrumental preludes and fugues. Music abided by the rules of the Reformation.

Geology teaches us of man's ascent as does paleontology. We may trace his laborious upgrowth through these means. Embryology reveals features which if they persist we brand as stigmata despite

* Part I appeared in the January issue, p. 152; Part II appeared in the February issue, p. 356.

their former worth in a lowlier state of existence. At certain stages we name the apparent phases in this continuous flowing procession of life. There we say is Amphioxus, here the reptile, the mammal, ape, man, for it were as though an invisible ether pervaded all living substance and united them in a bond. Thus when we speak of the Renaissance, the Reformation, Luther, Hutten, Loyola, Leo x, we point to peaks that arise from a continuous plane; heights made of the substance of the plane and only its reduplication, an intensification of its primal qualities. When we speak of Shakespeare, we feel the presence of Marlow, the compelling Elizabeth, the courageous subjects of Henry viii; we sense a spirit that defied Pope and the world, Spain and the Armada; we are in the presence of self-sufficiency, of greatness aware of itself and this power expressed in verse becomes King Lear just as a former manifestation of a similar energy became the tragedies of Aeschylus. It is a ripening of the spirit, a sign that the era has come of age and with the masculinity of its virile desires, seizes and compels. Later, old age appears, that men call decadence and historians write books on the decline and fall. The Creator alone is spared this degradation, for having no beginning he has no end. Even that which we call a sport, a red flower arising in a field that has only yielded white in the memory of mankind, obeys the Law of Mutation, which is only an expression of the force within that shifts and reassembles, separates, then reunites qualities, that like the integral notes of the octave, yield dissimilar harmonies though the elements be the same. For man awed at the formless void would have the Ruach of the Hebrews breathe upon the waste. He cannot endure immensity; infinity as a conception terrifies him and he partitions the unfathomable, groping in eternity with the symbols he calls classification. Only to the mystic, the seer, and the poet at the lightning flash of intuition, as brief and comprehensive as the vision of a drowning man, is it given to see time at a glance, space in a split second, so that the past, future, merge into one and the universe becomes as small as a grain of sand.

One regards the painting of the Repentant Magdalen by a representative of the Renaissance, Paola Veronese. The title is fallacious, for we have not a woman in grief, despite the presence of copious tears, the conspicuous bible and the grinning skull. She is brimming over with youth and spontaneity. Her beauty is that of Northern Italy and her golden hair, loosened, falls in a freely flowing cascade that accentuates the inadequacy of her garments. For her piety is all pretense. We perceive that thoughts detrimental to repentance occupy the girls' mind and combat the faintly attempted submission. The picture is saturated with the illusion of freedom, grace, youth and represents the abiding joy and spirit of the Renaissance. It is as free as the songs of Provençal or the lyrics of Petrarch and we behold the artist, the spokesman of his era, eloquently proclaim the renewed joy in life that the Renaissance has attained, a note once heard in the Athens of Phidias and still all-compelling.

Man in the past has spoken glibly of liberty but what he meant was a readjustment in his relationship to his fellow-man. He loudly vaunted the preciousness of truth which he knew at heart was but the prevailing conception of the moment, for the stoutly held theories of Newton have been superseded by those of Einstein, which will in turn be replaced by equally vulnerable assertions. Even the artist who loudly proclaims the integrity and immortality of beauty in line, rhythm, melody and color, admits the strange captivity of his Muse to fashion. For Shakespeare has in the past been forgotten for a hundred years and probably will be neglected at a distant date in the future. Bach himself, the founder of all that is worthwhile in music, was saved from oblivion only by the strenuous efforts of

Mendelsohn. The artist in attempting to escape from reality, to be master of a world in which reason, rules, logical sequence and harmony reign, at times finds even these resources inadequate and turns as did Shelley, from the mitigated portrayal of "The Cenci," to airy nothingness. Even tragedy divested of squalor, noble in its elevating passion and sincerity failed to yield that surcease he craved. He left the field that proved his mastership to spheres that contained but the promise of the fleeting inane, and to pinnacles that soar through a radiant emptiness, heights unsubstantial, though rainbow tinted. Even in poesy, Shelley failed to adapt himself and as he fled life, so did he the harsh reality of its portrayal. For he saw life as though it were the dread vision of Van Gogh: circular walls, that extended to heaven and down to hell and there was no seeing their height or depth, for they exceeded the capacity of human sight and within this towering circle of gray stone, a lesser circle moved, made of men, inarticulate in their wretchedness. The picture is suffused in a drab grayness and one notes only the dreariness of a living circle of men that participates in the coldness of the outer one of stone. The individual is lost in this unending cycle as is the gray stone in the immensity and barrenness of the surrounding wall. The two circles claim kinship and the hopelessness of the inner one diffuses and shares in the bleakness of the prison walls. We behold the captivity of life. No loud cry of despair is heard here, but only a sullen muttering, the residuum of despair and the round of futile action. For the convicts are not only confronted with the wall of reality but the stones that have replaced their hearts. It is as desolate as the view of a deserted burying-ground, revealed by a flash of lightning to the lonely traveller in the storm. Thus did Van Gogh see life, and oftentimes thus did Shelley. There is no respite and no hope, for how can men who share in the qualities of their prison walls, loosen their bondage? There is a kinship here and gradually the space between the deadly circle of stone and the one of living flesh narrows and the two become one; a merging of stone and men, the earth and blood, a vision that is the outpouring of madness, the effusion of the depressive stage of a manic-depressive psychosis.

V. The Spirit of the Humanists

To be a humanist was so exalted a state that they often took the name of poets, although the loftier design of the Muse was, at times, woefully lacking; what they missed in skill, they easily replaced by fire and vigor. Their intensity was in itself a thing of beauty; for men were become Gods once again as they had been in Greece and Galilee. They were uplifted with the sweeping flight of a soaring conception. The supine aquiescence of a laggard race was scorned and vigorous action urged. "Sweep aside," they cried, "excessive belief, crippling superstitions and partake of the waters at their source, than only shall ye be free." Their desires were laudable; they praised the integrity of the human understanding and the sacredness of the individual, his sanctioned stand against obsolete conformity and enslaving tradition, an attitude that was to produce Paracelsus. The world was enlarging and seas were merely bodies of water useful in navigation and not the brink of horror, chaos and unawareness. The world was finite, a minute planet encircling an insignificant sun. The heavens abounded with golden dust that made the earthly planet pale into futility. This grandiose view, like a vigorous draught of wine, intoxicated minds eager with the impatience of restless steeds. The tossing and stamping, curveting and wild flashes of eyes, were as nothing compared to the race they sensed, for they saw as their goal the twentieth century, when the desires of the alchemists were realized and gold produced from baser metals. Paracelsus was vindicated. Theirs

was the haste of the artist who would fain complete his masterpiece before death; completion meant perfection. The humanists were inspired with the passion of a Bach or Beethoven, but their harmonies were not oral but visual. They decried what they assumed to be the futility of perfection in a nebulous sphere of the future and felt that man's chief desire and justification of his existence lay once more in plotting out the garden spot of Eden, nor would they fear the angel at the gate with his gleaming two-edged sword. They did not require spells or incantations, but only a rigid scrutiny and compilation of facts, an adherence to natural phenomena. The process was far from a speedy one; the former highlights resembled the faint stirrings of the fetus in the womb which, barely perceived, culminate in the vigorous, encircling thrust of the child desiring to be born, and demanding its heritage from an unyielding environment.

The name of Luther was anathema to the monks but he was merely the visible outpouring of a river that had for centuries flowed underground, silent and dark, but with gathering force, until one day, men were amazed to see an unknown stream thrust its ever-widening circle about their doorsteps. The only constant thing is inconstancy. Radium itself loses its essence with the passage of time and the desire of the Reformers to renew the early Spring was futile because former conditions that had evoked beloved responses were gone forever. Nor could earnest search and pious endeavour recall them.

VI. Hutten's Views on Syphilis

"De Admiranda Guaiaci Medicina et Morbi Gallici Curatione ad Principem Albertum Cardinalem et Archiepiscopum." This was the title of a remarkable piece of work appearing in 1519, discussing a disease that was attracting considerable attention amongst the laity and the medical profession of the period.

Hutten relates:

It has seemed best to God, that diseases formerly unknown to our ancestors should arise in our age. In 1493 a pernicious disease appeared at Naples and although its name was taken from the Gauls, it did not arise there first. Before emerging elsewhere it was seen in the army of the Gauls which was fighting at Naples under King Charles. When first this disease appeared it was of such foulness as to scarcely bear any relationship to that which now exists; hard projecting sores, the size and form of an acorn were present; a foul excretion flowed from these projections; so marked was the foul odor exhaled, that infection was assumed to involve those whose nostrils were affected by the scent. The color of the sores varied from black to green; the afflicted suffered more from the sight than from the pain, although suffering also occurred if inflammation were superimposed upon involved areas. A rapid spread occurred in Germany, more extensive than elsewhere, soon after the original onset of this disease. This fact maybe attributed to our intemperance. The ensuing and diffusely prevalent infection that we have now, is less foul and more endurable because of the fact that the sores present are smaller and do not project as far and are harder; although at times a diffuse infection covers the body with a dry scale. The latter manifestations of the disease are more dangerous because their poison pierces deeply and are followed by other diseases.

It is our impression that this disease only inflicts those who have been exposed to contagion which is most regularly induced by intercourse. As a result we rarely find that boys, old men or others, who are abstemious, suffering from this disease. The usual recipient of this malady is the vigorous adult given to the gratification of passion. The duration of the disease, whether it be transient, persistent or lethal depends upon the mode of life of the patient. German doctors said nothing about the disease for two years after its inception. They began its treatment when I was as yet a boy. The results are very well known. Strange outlandish mixtures are used in the treatment and many things employed which are not worthy of being taught. This disease contains within itself many manifestations of other diseases and the sequences of events are much more malignant than the original manifesta-

tions would give us to believe. The joints suffer greatly. The onset of joint involvement is at first mild, but with the ensuing swelling and hardening that is a later result of cystic and tumor formation, inexpressive agony occurs. The pudenda in women are involved by small ulcers, sources of prolonged poisoning power, and because of their lack of visibility by the partner in intercourse, these sores are all the more dangerous. The sinews grow hard and contracted, and at times become distended; they may either relax or stiffen. Paralysis and apoplexy occur in some people. Leprosy ensues in many. So marked is the intensity of the pain at times that men shiver as though they had fever. Abscesses often form and change into cancer or into fistulas or even into persistent sores which extend to such an extent that bones are uncovered and the flesh of the infected limbs wastes away to a marked degree. Men become so emaciated by the prolonged illness that the body becomes a sack of bones: all the flesh having been devoured by the disease. Consumption is the result. Foul matter flows from the intestines and dropsy is frequently a sequel. The bladder ulcerates in some of the patients and the liver and stomach are very frequently involved and wholly destroyed by this desease. Nor must one attribute the ulcers, tumors, cysts and boils to the malicious effects of mercury, as these manifestations are part and parcel of the disease; although most of the German doctors stubbornly oppose this view; but then, irrespective of their numbers, they are shamefully mistaken in this matter, as they are in so many other diseases. I myself have seen this result involving many patients who never received mercurial treatment.

Because of the confusion of the doctors, the surgeons attempted the cure of the disease. The skin lesions were first burnt with caustics; because of the enormity of the task (due to the multiplicity of sores) ointments were devised. The latter were only successful when mercury was one of the ingredients. The patient was enclosed in a hot room which was vigorously and continuously heated for twenty, thirty or more days. He was forced to sweat, after the application of the ointment, by means of heat and covers. After the second application of ointment the patients grew very weak; those, who had not taken care of their mouths, lost their teeth. In all cases the throat, tongue, and palate were ulcerated, the gums became swollen, teeth were loosened, and a continuous flow of sputum poured through their lips with more stench than that of putrescent matter. The lips touched by this sputum developed sores and the inner aspect of the cheeks became infected. Many patients prefer to die of the disease than undergo this vigorous treatment; rarely was more than one in a hundred cured. A relapse followed after a relief of a few days. This description makes one realize what I endured from this disease, having undergone the treatment eleven times. All patients were tortured alike with heat and vapor, and the sick were treated without consideration of the duration of medication or the state of the body. I have seen many die during treatment. The deaths were accounted for by heat, swollen throats and anuria.

VII. Hutten's Description of His Own Infection

First I was helpless in my right foot, the disease having persisted there for eight years, and in the middle of my tibia there were inflamed, putrescent ulcers with swelling of the flesh, causing great pain of such a sort that when one healed, another broke out. Above these was a tumor, so hard that it was thought to be bone, and in that, a great piercing pain without cessation and measure. Above the right ankle there was a gathering as hard as bone. It would swell violently and with the greatest pain; now subsiding and then growing more moderate in its tendency. From this there was violent suppuration, almost inexhaustible. As often as I put weight on my foot I suffered from unendurable pain. Further up my hip and knee had become stiff and the thigh reduced to extreme emaciation. Each joint was dislocated so that for a long time I could only stand with the greatest pain; and finally not at all. One of my buttocks was entirely reduced to the vanishing point. My left shoulder was likewise in pain so that I could no longer lift my arm, the end of the shoulder blade was weakened and calloused. In the middle muscle there was a tumor the size of an egg while the rest of the arm extending to the hand was wasted away to an incredible thinness. On my right side, just below the lowest rib was a painless ulcer pouring out foul pus and filthy diseased matter. Above this was another abscess. Finally from the top of the spine a flux proceeded. I could not turn my face to the rear without turning my whole body with it.

VIII. Continuance of Hutten's Dissertation

Hutten complains bitterly of the inadequacy of the medical profession. He accuses them of lack of learning and skill, asserts that they have purchased the name of doctor that they may sell themselves to the crowd. "They are ignorant," he cries, "both of Greek and Latin literature" (a grave offence in the days of the Humanists and Reformation). He admits, in this report to the Archbishop, that he has also been accused of a radical onslaught upon lawyers and theologians. He emphasizes the point that he only attacked those whom he considered ignorant amongst them and opposed to the pursuit of the humanities. Then with a marked complacency, he adds that he is well aware of the Archbishop's knowledge of the situation. He then dismisses what he opprobriously terms the ambulatory dispensers of ointments, the medical highwaymen and those undoctored doctors. This poet who emits flame with the ease of Jason sowing dragons' teeth, speaks glibly of Asclepiades, Celsus, Galen and Hippocrates.

This dissertation is a very representative one of the pugilistically inclined scholar. One may discuss his attack on the Church entitled "Die Römische Dreifaltigkeit." His accusations surpass human belief, for even Torquemada had his redeeming qualities; the debt that the student owes his teacher, although the latter be deficient in necessary attributes, is lacking in this opponent of the established order. Hutten was an individualist; not the type that enriches mankind with inexhaustible treasures, that makes man feel that life were a sacred thing and something to be lived up to, that perfection although never attainable can be viewed in clear and clearer perspective on the road to self-denial and toil but was of the species that insists that life is a compound of hideous and cruelly suppressive unrealities that rear over the head of hapless humanity like an impending nightmare. Doctors were inadequate, stupid, avaricious and histrionical. Lawyers corrupt and the theologians knew nothing of God. Only he, Hutten, and in a greater or lesser degree his friends were aware of the eternal verities. He fought for the freedom of the press and the independent view, felt that salvation lay in the ability to think clearly and unhindered and that man must solve his own problems and deprive theocracy of its power. All his assertions make a magnificent tapestry of thought but the woof is discordantly marred by threads whose color signify the presence of a combative personality. Hatred and not love, was his cry, destruction and not understanding. He would serve the new order and destroy the old; would sweep aside, if he could, the work of fifteen hundred years, instead of adding the infinitesimal gift which only the greatest can supply. He was enslaved by the grandiose ideas of the Reformation and thought, dreamer that he was, that change meant perfection. He would not accept the lesson of the coral reef, could not realize that the green isle in the sea was a work of ages and the mausoleum of inumerable lives. He would not realize that the work of centuries could not be effaced overnight. The needs of the people will find expression and the existence of an institution is in a way its own Apologia. Corruption is but the barnacle that infests the ship and can be discarded and the mighty vessel will still fulfill its function. Hutten would destroy ship and infestation. We do not find in him the saintliness, the other worldliness of Servetus, the mystic enveloped in clouds of shining fire; but a weary, embittered antagonist of life and its works, seeing no pleasure in existence, save his beloved literature and viewing with disgust the manifestations of mankind. He would hurl them into chaos. One is forced to admire Milton's Lucifer, who defied God and outlined his matchless fortitude and ability to withstand punishment, his deathless determination and zeal, his confidence in his own ability, the integration of a powerful personality. Even Milton honored him

secretly, the Angel next to God, who had attacked Omnipotence but one wearies at times of Hutten and his eternal bickering and fault-finding. He apparently has most to offer to the man who is steeped in German nationalism.

The preservation of one's personality may be carried too far. The dementia praecox illustrates the tendency of the individual who wishing to preserve all the glamour of his illusions, retreats into the dim recesses of a well-high incurable psychosis and in protecting himself, commits the paradox of destroying his own integrity. The genius who would have things his own way and compel mankind to accept his unaltered and as yet unadaptable gifts, often escapes this self-destruction. Hutten wavers between the two and impresses one as a member of the border line, the fringe that narrowly escapes with its mental processes intact.

Erasmus, a much more learned man than Hutten, attempted to perfect this splendid world-wide structure, would remove a few excrescences from the imposing architecture; not so the restive Hutten who would throw a lighted bomb into the interior and revel in the ensuing destruction. The greatest of all virtues, that which a mighty race, the Pagans, extolled, was unknown to Hutten, although he loved their literature; the virtue of the middleway, of moderation. Hutten may have laid too great stress upon the function of the artist, who is not as important in the scheme of things as he assumed; for the artist is merely the sound that implies the presence of the sea; he is a voice of his generation, nothing more; only the shadow that the planet of mankind casts. The infirmities of Hutten were many. He also possessed splendid attributes. Liberty he loved and the value of human integrity, the exploitation of the individual conscience. Freedom, he blazoned, was essential. The fetters that had long confined the stalwart limbs of Europe, he helped sever. The amazing bounds and leaps that a liberated Science and Art made, that fled headlong into the glorious conception of twentieth century fulfilment, he helped realize. An eternal gratitude is his due for this fact alone, that he beheld the new thought in its obscure workings, when it was as yet formless and void, and that he, with prophetic vision, assisted it in its realization. He loved mankind but not men, humanity but not the individual, learning but not its adherents. A shrewd, meticulous observer, versatile, gifted in many spheres; an upholder of the new faith, but in reality a free thinker. His motto was: "Change for change sake." One finds similar individuals who resemble him amongst the great; Byron the unstable and profligate, ever seeking an evading happiness, and the fulminating Swift, whose words wound like the bite of an enraged adder. To say that Hutten's rage against mankind is due to a hard life is an inadequate statement. He would not adapt himself; refused to learn a profession, spurned the accepted degrees of his period which the public demanded, saw the world as his home and yet praised the conception of a mightier Germany; would have his fatherland triumphant, still despised the German citizens and learned men, accusing them of excess. He was at war with himself and was torn by conflicting tendencies.

Hutten arose from an ancient German family, from the flower of manhood. Born April 22, 1488, in the Castle of Steckelberg in Fuldaischin, he was destined for the priesthood by his father, because of an apparent physical weakness, as he was obviously unsuitable for the arduous life of a warrior knight. The love of religion bore no relationship to his religious assignation. The Church was an outlet for the accessory sons of the nobility when it was impossible to give them the suitable requirements of their class. Therefore Ulrich, when eleven years of age, went to the monastery school at Fulda, where the monks taught him until he was fifteen. The boy took to books like a duck to water, displeasing his father, who regarded the desire for learning as a degrading tendency, one which threatened the su-

premacy of his class that subsisted by arms. Aware of the importance of the nobility, its utter reliance upon the sword and not the pen, the contempt which the elder Hutten felt for mere knowledge may have been the defensive reaction of the ignorant, which ridicules what it does not fully understand and which it assumes does not enter into the mechanism of the assumed importance of its own caste. Hutten failed to find his vocation in a cloister; he was of the earth, earthy. The monks' efforts to restrain him within walls made him bent on determined opposition. He fled at seventeen to a restive world that had long awaited him. The eager world opened wide her arms to this impatient boy, who sensed through intuition his great destiny. He would eventually be forced to ascend the mount of Calvary, from which height his eagle glance would sweep the world; what though his crucifixion were to be not on hewn boughs but upon a lonely isle. He was young, however, and spared the vision of his deplorable fate. There were many things to be done and he revelled in the draught of life, though bitter-sweet. How fortunate was Hutten to be born in a period that had come of age and like the chrysalis long imprisoned, takes to itself wings and flight. The heady fragrance of liberty lured Hutten on; the very air was saturated with the persuasive scent and he, exhilarated, fled from land to land to participate in the revel of the senses which the revival of learning had liberated. Freedom, to Hutten, was primarily one of the mind, for with the aptitude of artist and scholar, he would suffer no bounds.

Students were deserting the schools sanctioned by precedence and authority and flocking in multitudes, eager to listen to the counsel of learned men who discussed the ancients. Virgil and Terence were not merely poets but the guides to a new way of life. Books were still very scarce and the eager students painstakingly took notes of the information given. New universities were springing up like mushrooms. Learning had become fascinating and men were enthusiastic about Grecian drama, poetry and the original sources of the Scriptures. Students wandered from country to country, owing no allegiance save that to learning.

Hutten went from Erfurt to Köln, from the latter to Frankfurt, then to Greifswald, Rostock, Olmürtz, Wien. He was forced to subsist on his own unaided efforts. He grew familiar with Lady Poverty and recognized only too well her dismal crew of Misfortune, Disease, Hunger, and Cold. It is only well-fed poets who sing in flowing numbers of graceful Poverty. She is not a rosy-cheeked milkmaid, but an emaciated witch and thus Hutten knew her. He strove on however, where many another man would have yielded and perished, impelled by the incessant desire to fight tradition, the Church, Medicine, antiquated learning, everything that opposed the revised way of regarding the world. He was kept alive by his hostility to the world as it was and the hope of seeing a newer, better and more enlightened state of affairs as he conceived them to be. He felt within him the celestial nucleus that differentiated him from most of the world at large and in his self-knowledge bore affliction not graciously but well. Hutten could fight like a cornered leopard, that though opposed by a more vigorous enemy, will turn over on its back and rake vigorously with distended claws the exposed abdomen of the opponent. Often did Hutten curse his environment and his enemies but still he would not be daunted. At twenty-four he could not resist the desire to visit the birthplace of the Revival of Learning and the Renaissance, the home of humanism and culture, Italy. He sought learning in Pavia and Bologna but failed to be satisfied. He never would, because his reach always exceeded his grasp. He remained three years in Italy. The wearisome repetition of want and hunger pursued him here as it had in Germany and he was forced to become a soldier. Hutten was courageous and defeated five Frenchmen, singlehanded, who had mocked Em-

peror Maxmilian. The love of writing however had possessed him and in the midst of turmoil and the battle-field he composed Latin verses. The desire to uplift and change existing circumstances are revealed in his verses, for the humanists were reformers. He despised the Germans for their supineness, their credulity, superstition and softness. "Be once again conquerors, as you were of yore, instead of dupes," he cries.

Wann doch kommt es dahin dass Deutschlands Augen sich öffnen,
Einzusehen, wie ganz Rom es zur Beute gemacht?
Wann doch kommt es dahin, dass um Gold man bleierne Bullen
Andern Völkern vielleicht, nur nicht dem deutschen verkauft,
Oder wird so wie jetzt dein Deutschland's mächtiger Kaiser,
Immer ein Spott nur sein für das beraubende Rom?

Despite his increasing fame, his father would have naught to do with him, until Duke Ulrich von Württemberg killed his equerry, Hans von Hutten, in a wood, for love of the latter's wife. The Hutten family rose up in arms against the Duke. Ulrich von Hutten wrote burning letters, condemning the murderer and informing the educated men of the day of the situation, asking for revenge. He desired the support of intelligent public opinion. His family, seeing his power and perceiving advantage to be derived from his help, forgot his stubborn, iconoclastic attitude, his contempt for existing standards, the deplorable days of his vagabondage, and renewed their friendship. But still he disappointed his father by refusing to follow the accepted path, ignoring degrees which he considered the insignia of the pseudo-learned. He went again to Italy, not as a law-student this time but as a full-fledged humanist. His Latin verses were hailed in Germany, Italy, France and England. Many gazed upon the famous poet with eagerness and wonder. He reached the peak of his good fortune July 12, 1517, when at Augsburg in the presence of the royal household, Maximilian crowned him with laurel leaves. A poet could go no further.

IX. The Holy Roman Empire and Hutten

Hutten had desired a renewal of the former glory of Germany; her undisputed sway over Europe, the former territories of Rome. He wished to revert to the status in which a German Emperor was the superior partner in the politico-religious amalgamation known as the Holy Roman Empire. The latter institution was based upon two forceful conceptions: one being that the extensiveness of Rome's dominion, its universality, led men to confuse space with time and they made the two terms, diffuseness and eternity synonymous. They would not let Rome perish but wished to keep alive an idea that had once lived and stirred man by its greatness. It would live centuries hence in the minds of the world as a splendid delusion.

For hundreds of years had Rome of the eagle standards, the suppressor of barbarians and the leader of civilization, ruled. Her scope was universal and included the most thickly populated and richest parts of the world. So deeply had her speech, customs, law, ideals penetrated, that the very strata of Europe bore Roman insignia. Habit had inculcated worship of Roman methods and authority. Europe could not realize the transiency of the most stable codes and tenaciously adhered to a worn-out formula long after its use had departed. Rome, men felt, must be eternal. The Roman poets, jurists and orators from the end of the republican period had continuously chanted her predestined immortality and asserted that her world-wide control would never cease. This theory of an eternal state was not permitted to perish despite the decline and fall of Rome; for the Church fair and strong in her childhood, assumed the prerogatives of the secular empire and desired to rule the world as the Pagans had done, making blessed with sacerdotal

ceremonies the conception of a universal and eternal state. The idea was centuries older than Christianity, but it would not perish for hundreds of years more to come; the rulers of the world would not be laymen now but priests, and the altar would replace the throne.

The second important element in this idea was the union of the Church with an Emperor, one above authority. He was the seat of honor and power which he dispensed as he saw fit. He had been worshipped in the past as a divinity and possessed extraordinary legal power. His imperial edicts transcended all laws made by the people, senate and magistrate. His domestic council was the highest court of appeal and he could, by an edict, overule all law. From the period of Julius and Augustus, his individuality had been consecrated by the office of chief pontiff and tribunician. No higher oath existed than that which swore by his head; images with his resemblance were holy and he was worshipped in temples as though he were Apollo or Jupiter, whilst still alive. The designation Divus was his after a death made sacred by consecration. Christianity abolished the worship of a man but the desire to revere his memory persisted and also the wish to perpetuate his authority over Church and State; this power was admitted at Nicaea and was continuously employed by the Sovereigns of Constantinople. Thus the Emperor was as important in the new Christian world state as he had been in the warrior state Rome of old. The Holy Roman Empire became the possession of a German prince, Otto the Great and to him Hutten makes emphatic reference in his appeal for the destruction of a power that had, he assumed, usurped regal authority. The Church had grown wealthy and militaristic and bishops led armies to war. In the eleventh century practically half of the German lands and a considerable part of its military strength was possessed by the clergy.

The middle ages were unpolitical. Conceptions that were readily understood by the ancients such as the idea that the State's chief purpose is the protection of the rights of the people, were theoretically unrecognized. The comparative merits of different forms of government were never discussed. The barbarians, ignorant of wide political union, had considered differences of race and religion an insurmountable obstacle to union; their peculiar gods were alone considered worthy and those of their neighbours despised as unclean and worthless. Rome gave man a common cause and language and overcame his scruples born of ignorance. She made him one politically as Christianity did religiously. The new religion formed a strong community, the members of whom were children of the one true God and they banished the tribal deities of wood and stream into the land of forgotten things. Unity was realized and the Church and Empire united mankind. The Church alone weathered the turbulent fifth century. Rome had perished.

The unripe minds of the Middle Ages, faultily trained and disciplined, could not cope with abstract ideas. They demanded signs. They realized the import of Christ's sepulchre because it was a concrete object and crusaders travelled at the risk of their lives through inhospitable regions which they often rendered desolate, to view it; but to serve this godly spirit in their hearts was incomprehensible to them. They would have parables interpreted literally, symbols made into ceremonies and could not grasp the Deity in his spiritual essence. They seized the fleshy medium of Madonnas and Saints to give sustenance to their religious aspirations. Great artists created pictures and images to satisfy their intensely concrete devotional attitudes. Force must have form, they insisted, and numerous Madonnas in brilliant pigment adorned the canvasses of the faithful. A noble desire was not an impulse in itself but the act of an angel (a beautiful spirit with wings that lived in a heaven whose confines, floors, location and height were accurately delimited). Heaven lay directly

above the earth and was shaped like a vault. There were seven floors to Paradise and the more perfect the soul, the higher it rose. Ecstasy bore a definite relationship to height. Hell was directly below heaven and separated from this architectural device, by the earth, where man insignificantly poised between the two verities, passed an existence of little value because it was short in duration. Here again the concrete enters. Had man's life on earth been as prolonged as it was in Heaven or Hell, Earth would undoubtedly have influenced the minds of medieval metaphysicians and artists more markedly. When men sinned, the devil was blamed. Man's soul was a vast stage where supernatural beings disported, the good on one side and the evil on the other. Haggard witches and frowning devils opposed the winning smiles and blessed attributes of the angels. It was a devil who goaded man into sin; for man was apparently a passive creature and very susceptible to the action of the Prince of Darkness. The Devil could disguise his ugly body into the semblance of a milk-white form; he could alter his hoarse, cracked voice, into the melodious accents, honeyed and flowing, of Saint Michael and Catherine. This was a well-known fact. Had Jeanne D'Arc only listened to the group of men who were alone capable of decision on this momentous question, she would never have burnt, but Jeanne was obstinate and claimed that people were quite capable of fending for themselves and differentiating angels from devils. This statement was heretical and condemned her. Purity lay not in the rigorousness of the mind but in a wondrous cup haloed by a heavenly phosphorescence. This vessel was called the Holy Grail.

The entire composition of medieval Christianity was based upon the conception of the Visible Church. Luther and Calvin turned away from relics and saints, madonnas and pieces of the True Cross, and sought the spirit of Christ in their own hearts. Calvin had great difficulty in his quest; the memory of the charred body of Servetus lay like an insuperable barrier between his desire and goal. The medieval mind was cruel, at times inhuman and revolting. Bryce states:

> At no time in the world's history has theory, pretending all the while to control practice, been so utterly divorced from it. Ferocious and sensual, that age worshipped humility and asceticism; there has never been a purer ideal of love, nor a grosser profligacy of life.

The Emperor Otto, the German Kaiser, had had great power for he ordered the dethronement of one pontiff and the installation of another; but the power of the Emperor was to wane and the genius who was at the same time Pope, Gregory VII maintained that a grievous wrong was committed when an ecclesiastic received his benefice from a layman. He mortally wounded secular authority by condemning the entire system of feudal investiture. Thus the bishops and abbots who possessed half of the wealth of Germany, now passed from the powers of the Emperor to that of the Pope. Government under such conditions was extremely difficult.

The German Kaiser, Henry IV, quarrelled with the Pope who summoned him to Rome for judgment. The Kaiser, infuriated, assembled a council that defied Gregory. The courageous Pope immediately excommunicated Henry and designated the day on which, if he still remained obdurate, he would cease to reign. Gregory, the famous Hildebrand, meant to be master of the situation and he won, because Henry's subjects revolted. Europe was treated to the spectacle of seeing her mightiest prince subject to Peter's throne and craving forgiveness. Henry for the good of his soul was compelled to stand barefoot on the snow, clad in a woolen garment for three days and nights; he was then absolved. He would never overcome this disaster, this overwhelming loss of dignity and prestige. The humiliation of the event was remembered by Hutten's contemporaries and made the former's battlecry even more vociferous. The Em-

peror was no longer the highest power on earth, there was one greater than he, Gregory VII, Bishop of Rome. The kingdom of the spirit was superior to that of the flesh and the Pope to the King. All mankind was to be subject to Peter's successor who would not only be the donor of the crown but its remover. Hutten desired to have the powerless Kaiser Maximilian exert the influence of the great Otto. Germany's glory must be restored!

X. Differentiation between Hutten and Luther

Hutten's combat against Rome was entirely different in its aims from that of Luther. The former was not concerned with the salvation and integrity of the soul. Love of country, distaste of seeing much German gold enrich the coffers of the stranger, a desire to see Germany as powerful as she was during the days of the Holy Roman Empire, forced him onwards. Franz von Sikkingen enabled Hutten to continue his plans for the liberation of Germany. Sikkingen was a stalwart knight and belligerent leader in the field; although far from studious, he nevertheless inclined a favorable ear to the scholar-poet. Knights still persisted, despite official forbiddance, in waging war on towns, merchants, caravans and living on plunder. It was their means of livelihood. They disliked peace. War was their justification, a glorious end in itself, fortifying their manliness, skill, and furthermore enabling them to live on booty which they would not recognise as that of theft but as the just reward of knightly efforts. They could easily justify their ways by a beneficent philosophy, if they ever paused to think, which was very seldom. Cities existed for exploitation, sheep for wolves, merchants for plunder and towns exposed their wealth like marrow bones, an irresistible temptation, for the axe could easily expose their hidden riches. Hutten found a tower of strength in Sikkingen. The function of the knights was rapidly falling into obeyance but with the tenacity of a warrior class they hung on to a world that was wearying of them and the feudal system and finding other avenues of expression. The honor of one era was becoming the bane of its successor. Sikkingen, impressed by Hutten, only too eagerly embraced the thought of Freedom. The words, liberty, license were synonymous to him and meant the means for further brigandage and loot. Sikkingen placed his castles and armies at Hutten's disposal. Sikkingen also defended Reuchlin and Luther, Luther's disputation at Leipzig in 1519 interested Hutten and he forgot his antipathy for the monk in his admiration of the man. He saw the similarity of desires despite their varying aspects. Luther and he were striving for Freedom; one for the religious aspect and the other for the national, comprising its literary, economical and political views. Hutten admitted that Luther was a greater man than he and in this confession shows nobility of character.

To Cardinal Albrecht, Hutten wrote:

> The doors have been closed to me, from homes, cities, to my pain, and from the golden Mainz. I am barred from the hospitable and cultured, a man who is innocent of crime or misdemeanor and guiltless of outrage, one who supported truth, who yearned for the best. I am excluded without a hearing, yea, they would even drag me to Rome for punishment.

He ends with a mingled appeal and condemnation, "Blutes in sich, den solche Frecheit nicht bewegte, solcher Frevel nicht empörte?" The Kaiser, Electors and Cardinal were mute; Hutten than appealed to the public, to the men of Germany. In 1520 he issued a compilation of his grievances. The tracts gained a wide circulation amongst the people; further editions were required. The frightened publishers were forced to continue the publications for they feared Hutten's friends more than his enemies. Hutten determined to realize the full import of his message, now wrote in German. He understood that if Freedom were to be acquired, the arbiters of her destiny would not be the learned of the realm, but the simple unlearned masses. He therefore appealed to these. He saw

Luther's great success and attributed much of his good fortune to the use of the German tongue. He followed his successful precept and won a large following amongst the multitude. Castles, monasteries, the homes of the bourgeoisie, the peasant's hovel and the palace of bishop and emperor heard of his greatness and thought of him in direct proportion as the relationship of his propaganda bore to their welfare. To the humble and aspiring he was a benefactor and therefore loved; to those whose future was menaced by his fiery words, he was an ememy. Even Maximilian feared his friend Sikkingen and dared not offend him. Alexander once complained, "In truth the only power in Germany is Sikkingen."

Luther did not reciprocate Hutten's ardent friendship, for the former believed in the power of the "Word" and disliked bloodshed. It was abhorrent to him and he could not understand that revolutionary steps, no matter how good the intentions of the leaders, if followed by the crowd, mean blood; for the mob is ruthless, a being of insensate passions and devoid of reason. It rushes its victims to the stake, guillotine and firing squad. Luther, like the patriarch of old, saw God in a burning bush, (what though the vision sprang from within and was propelled outwards, it was no less real for that) Luther who married and was forever afterwards embarrassed by the memory of this physiological occurrence, did not require the averted faces of his hesitant friends to remind him of what he assumed to be a grievous error; for he was a man of convictions, sincerity and boundless vision, who though death be the penalty, could only fling out his arms and cry, "I cannot do otherwise." Thus he was a sorry team-mate for Hutten, although both labored under the same yoke, the liberation, political and religious of their native land, the birth although they but faintly realized it of what was to be a full-fledged nationalism. That which had incited Luther, impelled him on his perilous task was an overwhelming impulse that surged from within and rendered him helpless so that he would have eagerly beheld a splendid creation, the work of a thousand years and many gifted men crash to dust. His inward turmoil revolved about the word of God as he conceived it. There was magic in letters and numbers. The Jews with their number ten, the Egyptians, Greeks, Christians all had sacred numbers and now syllables had also acquired a magic essence and were as a crucible into which Divinity was poured, whose semblance was the Word. Luther would destroy but he would not have bloodshed. He found Hutten repellent, a man of a lesser sphere who would kill priests, as defenceless a deed as the murder of women and children. Their tactics were different and Luther believed that Truth alone makes men free, and that healing words would make men throw away age-long bonds that had contaminated the flesh. Impetuous, volatile, torn by conflicting emotions, borne of exigent circumstances, he still was consistent in the newer conception of spiritual salvation and earnestly believed that the splendid code that had survived for centuries could no longer play a beneficent and worthy role. He even disliked corresponding with Hutten; felt that this link with so merciless an individual was shelf-basement. He cried,

> The Word had elevated man, had consecrated him and was the vehicle of immortality for it partook of the flawless and divine. The world has been overcome by the Word and by the Word shall the Church be saved, and the Word will always nourish and sustain her. Yea, even Anti-Christ himself will be destroyed by the power of the Word alone.

One thus readily perceives the alien temperaments of the men, one a Prophet and the other a Warrior. The Sermon on the Mount was incomprehensible to Hutten, who could only see with a visual apparatus confined by a belligerent nature. Luther had within him the flame of Hosea. Religion was a pretext for one, it was life and more than life, reason for human existence for the other.

"Destroy," cried Hutten.

"I cannot do otherwise," appeals the more humane voice of Luther.

But history has a way of laughing at the motives of men and points a tireless finger at the results which appear too similar to be explained by coincidence alone. Both men, although they were the obverse and reverse of a coin, bear the stamp of the same era which they helped to fruition. Luther may have spurned Hutten's friendship, but posterity groups them together.

After Sikkingen's death in May, 1523, Hutten went to Switzerland. There was nothing to hold him in Germany now. He sought Erasmus in Basel, but the latter refused to see him; was frightened. His friendship was dangerous and the scholar therefore avoided him. Hutten's great esteem for him changed to a bitter contempt. He wandered from Mühlhausen to Zurich. The renewal of his wanderlust goaded him on remorselessly. Towards the end of his life he was to repeat the wanderings of his youth but now he was spent, and old for his years, and no longer burned with the desire to free mankind, ennoble literature and crush the tyrant. All that he sought was a refuge and in his extremity was befriended by Ulrich Zwingli, the Swiss humanist. He died on the island Ufnau, Aug. 1523. His quest had ceased and Death was a more efficient physician than Guaiacum and not only relieved him of lues but of that long disease, his life. He was thirty-six years of age, and the companions of his youth, Lady Poverty and that dread disease of the Gauls, alone attended him to the grave; away from the land he loved and had dedicated his life to; his powerful friend dead, deserted by Emperor and avoided by Erasmus: still he had fought a good fight and long and although he be forgotten he helped form a nation that has made immortal contributions to mankind. Hutten needs no other epitaph, for Time has vindicated his claims and confirmed his assertions.

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BOOK REVIEWS

DIAGNOSIS AND TREATMENT OF DISEASES OF THE THYROID GLAND. By George Crile and Associates. Phila., W. B. Saunders Co., 1932.

Anything from the Crile Clinic on thyroid is worthy of more than ordinary consideration.

It is stated in the Preface that "This volume is not a formal treatise on the thyroid gland; it is rather an account of the experience of the Staff of the Cleveland Clinic in the treatment of diseases of that organ." The book will be indispensable to those who do a large amount of thyroid work and by others it will be found an invaluable work of reference. There are 24 authors, each chapter being handled by the man who has done the most work on the subject. The chapter on "Iodine and the Thyroid Gland" by George Crile, Jr. is of particular interest and value. References to the literature are given where necessary and the illustrations leave little to be desired.

PAPERS RELATING TO THE PITUITARY BODY, HYPOTHALAMUS AND PARASYMPATHETIC NERVOUS SYSTEM. By Harvey Cushing. Springfield, Ill., Charles C. Thomas, 1932.

This volume consists of reprints of the following four papers:

"Neurohypophysial Mechanisms from a Clinical Standpoint," Basis of the Lister Memorial Lecture, delivered at the Royal College of Surgeons of England, July 9, 1930.

"Posterior-Pituitary Hormone and Parasympathetic Apparatus," Basis of the William Henry Welch Lecture at Mount Sinai Hospital, New York, April 30, 1931.

"The Basophil Adenomas of the Pituitary Body and Their Clinical Manifestations (Pituitary Basophilism)," Basis of the Alpha Omego Alpha Lecture given at Yale University, February 24, 1932; also presented at a meeting of the Johns Hopkins Hospital Medical Society, February 29, 1932.

"Peptic Ulcer and the Interbrain," Basis of the Balfour Lecture, given on Lister Day at the University of Toronto, April 8, 1931.

It is interesting that the author starts his Preface with the following statement: "In this volume from their scattered places of publication, four papers on correlated topics have been brought together for the convenience of those whom the general theme may interest. Though they contain statements some of which I would be glad to modify and others to retract altogether, the papers stand essentially as published." Although the author makes numerous comments throughout the book, it is a pity that the above statement stamps this as not being what we would like to have—that is Dr. Cushing's latest opinions on the subject.

With the author's customary thoroughness, the subject is well and completely covered. It is a fine thing to have the papers available in one volume. In spite of the author's modesty, it is to be doubted if there is anything more complete, thorough and authoritative to be found on the subject anywhere.

THE HISTORY OF DERMATOLOGY. By Wm. Allen Pusey, M.D., LL.D. Springfield, Ill., Charles C. Thomas, 1933.

In 200 pages, Dr. Pusey has succeeded in giving a complete and authentic outline of the history of dermatology in a way that may be taken as a model by authors wishing to write the histories of any other specialty in medicine.

Dr. Pusey has taken a theoretically dry subject and put into it all the elements of human interest that go to make interesting reading. This is a book that every dermatologist should read and that every student of medical history will want to read.

THE PRACTITIONERS' LIBRARY OF MEDICINE AND SURGERY. Vol. III. N. Y., D. Appleton & Co., 1933.

Volume III of The Practitioners' Library of Medicine and Surgery is on "Practice of Medicine." Here is a 1400 page volume that is really "a practice for the practitioner."

As stated in the Preface, "Typhoid fever is less extensively treated than in many of the older treatises, but typhoid fever is a disappearing disease." Tularemia and undulant fever and allergic diseases on the other hand,

are extensively discussed and of primal importance to the practitioner today.

The volume is another indication that this new system of medicine is bearing in mind the needs of the practitioner and filling in a very necessary gap in the working armamentarium of the general practitioner.

Office Surgery. By Fenwick Beekman, M.D., Phila., J. B. Lippincott Co., 1932.

This volume of 400 pages is the tenth volume of the Everyday Practice Series edited by Harlow Brooks, who has written the Foreword. No surgeon will differ with the author in the statement that "there is no such thing as 'minor.'" The point is made that this volume is intended not to compete with the numerous volumes which are already available under the title of Minor Surgery but rather is intended to describe the indications and technique for such surgical procedures as any general practitioner is apt to be forced to undertake in his office.

As Dr. Brooks well states: "Every general practitioner must prepare himself at least in the elemental principles of surgery, even though he does not choose to operate himself, except, perhaps, in the most insistent of emergencies." No book, of course, should be expected to give adequately all such necessary preparations. But added to the clinical knowledge which is possessed (or should be) by every general practitioner, there is no doubt but that occasional reference to Dr. Beekman's book will be an invaluable aid in insuring proper handling of such cases as may be necessary.

The book is concisely written, and yet perfectly clear and complete enough for the purpose intended. To those who have use for a book of this nature, no better work is known to the reviewer.

The Art of Anaesthesia. By Paluel J. Flagg, M.D. Ed. 5, Revised. Phila., J. B. Lippincott Co., 1932.

During an interim of sixteen years, this book has gone through five editions. The last one has been revised to include the latest methods of general and spinal anesthesia up to the time of publication.

Dr. Flagg makes a special plea for consideration of the anesthetic best suited to the case rather than application of the case to the popular drug or method most talked about at the time of the operation. Platitudinous as this statement may seem, it is one that anesthetists and surgeons ought to bear constantly in mind for, unfortunately, almost subconsciously one is apt to fall in the habit of routinely doing the same thing rather than giving due consideration to the necessity of the individual case. It cannot be emphasized too strongly that here the consideration of the individual is at least of as equal necessity as it is in therapeutics.

At this time when almost every day brings us a new and seemingly improved local or general anesthetic, some of which drugs actually take their place as definite steps forward but more of which have slight careers as a fad and are soon forgotten, it is particularly important that a conservative philosophy as expounded by the author of this book be taken to heart by all those engaged in the administration of anesthesia.

Diseases of the Nose, Throat and Ear for Practitioners and Students. Ed. by A. Logan Turner, M.D., LL.D., F.R.C.S.E., and Contributors. Ed. 3, N. Y., William Wood & Co., 1932.

This is the third edition of this textbook since 1924. This edition has been subject to careful revision and seems to be right up-to-date. The appendix consisting of formulae will be found of great practical value.

With the entire subject of nose, throat and ear covered in something over 460 pages, the work is, of course, condensed but it is consisely written and covers more ground than first appearances would indicate. For quick reference, it will be found very convenient.

Krebsverbreitung, Krebsbekämpfung, Krebsverhütung. By Erwin Liek. München, J. F. Lehmanns, 1932.

This book with its extremely comprehensive title sums up the cancer situation as it is today. While offering nothing to the cancer specialist, it may be found convenient for quick reference by the general practitioner.

THE 1932 YEAR BOOK OF RADIOLOGY: DIAGNOSIS, Ed. by Charles A. Waters, M.D., and THERAPEUTICS, Ed. by Ira I. Kaplan, M.D. Chicago, Year Book Pub. Inc., 1932.

This new and much needed year book is divided into two parts: Part I on Radiodiagnosis, edited by Charles A. Waters of Baltimore, and Part II on Radiotherapeutics, edited by Ira I. Kaplan of New York. Both parts have abstracts of the leading articles representing advances in the subject during the previous year. The abstracting is well done. Comments are added by the editors which considerably enhance their value. There are many illustrations which are well selected and well reproduced.

The editors have succeeded in selecting the high spots from the radiological literature of the year and the material has been well edited and well indexed so that in this year book the worthwhile literature of the year will be available annually. For those who wish to delve further, accurate references are given in each instance to the original source material.

This volume, which represents the latest in radiology, will be found valuable by every physician and surgeon and to the specialist will be absolutely indispensable.

The editors are to be congratulated on the successful accomplishment of an important task. In this first volume, the editors and publishers have set for themselves a high standard which, if adhered to in future volumes, will insure the success of the publication.

BOOKS RECEIVED

All books received by THE AMERICAN JOURNAL OF SURGERY are listed in this column as soon as possible after their receipt and this must be considered as adequate acknowledgment. Books that the Editor considers of special interest to our readers will be reviewed in a later issue.

ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE OF THE U. S. FOR THE FISCAL YEAR 1932. Wash., Gov. Printing Off., 1932.

CHAPTERS IN AMERICAN OBSTETRICS. By Herbert Thoms, M.D. Springfield, Ill., Chas. C. Thomas, 1933.

CHIRURGIE DER WIRBELSÄULE (DIE). By Ernst Gold, M.D. Stuttgart, Ferdinand Enke, 1932.

FADS AND QUACKERY IN HEALING. By Morris Fishbein, M.D. N. Y., Covici, Friede, 1932.

ONE HOUR OF MEDICAL HISTORY. By Benjamin Spector, M.D. Boston, Beacon Press, 1932.

SHORT PRACTICE OF SURGERY (A). By Hamilton Bailey, M.D., and R. J. MacNeill Love, M.D. London, H. K. Lewis & Co., 1932.

SHORTER ORTHOPEDIC SURGERY (A). By R. Brooke, M.D. N. Y., Wm. Wood & Co., 1932.

TEXTBOOK OF SURGERY (A). By John Homans, M.D. Springfield, Ill., Charles C. Thomas, 1932.

TRANSACTIONS OF THE AMERICAN GASTRO-ENTEROLOGICAL ASSOCIATION, 1932. Boston, Purchasing Bureau, Council of Social Agencies, 1932.

ACUTE INTESTINAL OBSTRUCTION

MONROE A. McIVER, M.D., F.A.C.S.

THIRD INSTALLMENT

PART I: THE DISEASE

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Chapter VII

VARIETIES OF OBSTRUCTION (Continued)

Internal Hernias

Intestinal obstructions coming about as a result of internal herniation through abnormal openings, or slits, congenital or acquired, make up a small group (see Fig. 2*).

Herniations into the abdominal fossae form an especially interesting group (see Fig. 30). Many points dealing with their anatomical and clinical features will be found in contributions by Moynihan,[1] Short,[2,3] Copenhaver,[4] and Masson and McIndoe.[5] The common sites of these fossae are in the region of the ligament of Treitz—the so-called fossa duodenojejunalis—and in the region of the junction of the ileum with the cecum, from which arise the ileocecal fossa, the subcecal fossa, etc. There is also one which is sometimes found in relation to the sigmoid—the intersigmoid fossa, the opening in the mesocolon occurring on the left side of the sigmoid, over the bifurcation of the ileac vessels. Extremely rarely the bowel may herniate into the lesser peritoneal cavity through the foramen of Winslow and become obstructed.[4,6]

A group of hernias that are usually classed with those just described are hernias of the intestines through the diaphragm into the thoracic cavity. These openings of the diaphragm may result from congenital defects or from injury.[7] Where obstruction occurs in such hernias the mortality is usually high.[8–12]

Herniation and subsequent obstruction may also occur through openings in the mesentery, omentum, and broad ligament of the uterus. According to Treves[14] the openings are most frequently found in the mesentery of the lower ileum and are generally circumscribed by an anastomosis between the ileocolic branch of the superior mesenteric artery and the last

* This figure appeared in the January, 1932, issue of the Journal, page 177.

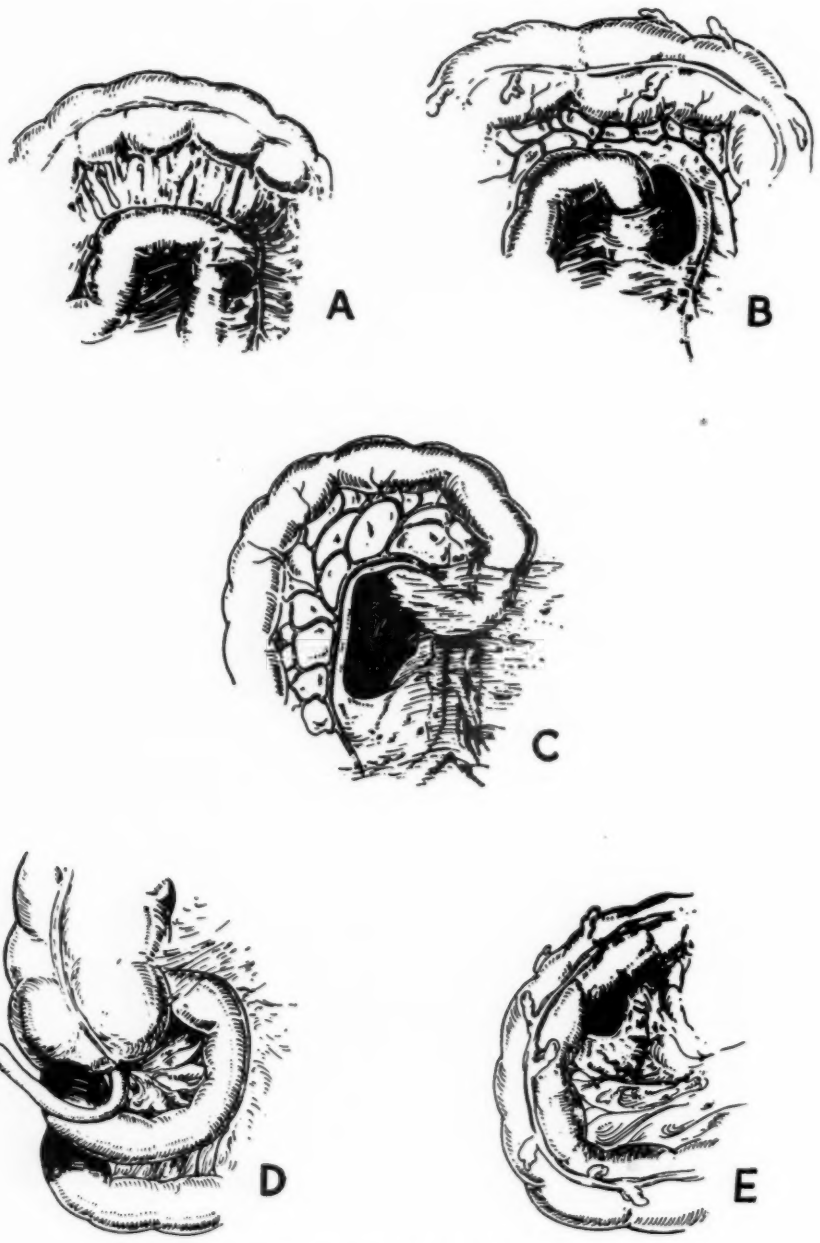


FIG. 30. More common types of retroperitoneal fossae. (Short[3])

of the intestinal arteries. (See Fig. 33.) The openings may vary considerably in size and not infrequently permit the entrance of a considerable portion of bowel. According to the afore-

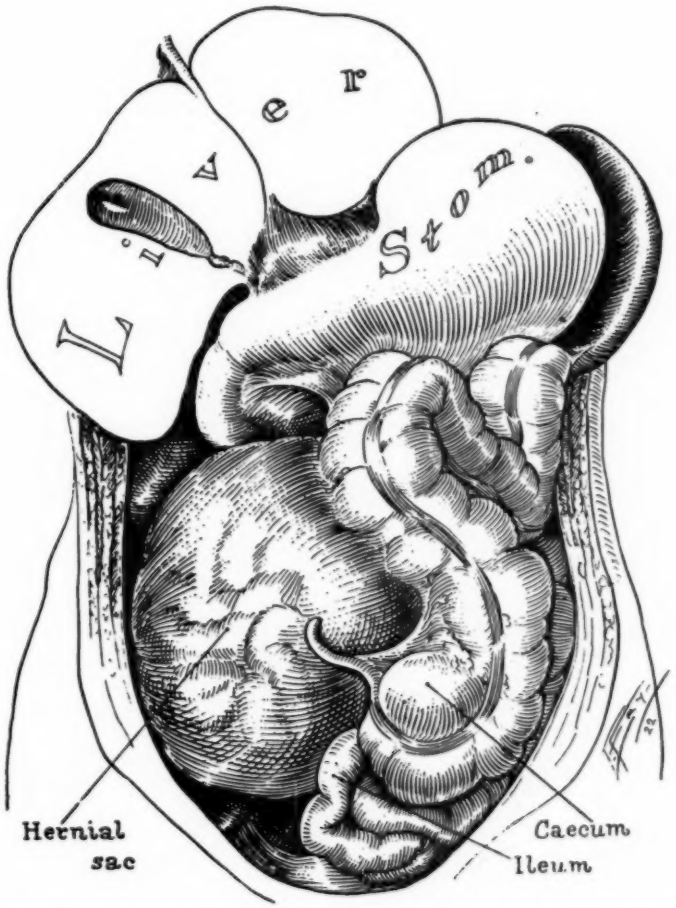
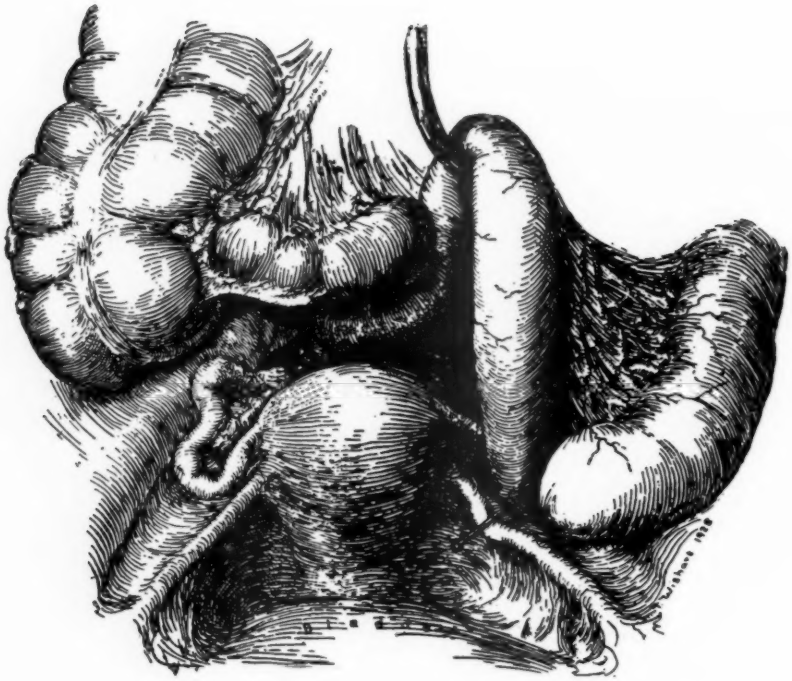


FIG. 31. Pericecal hernia with transposition of cecum. Sac contained practically all of small intestine which had entered through an opening beneath ileocecal valve into root of mesentery of cecum, extending upward and to right. (Copenhaver[4])

mentioned author, these holes in the mesentery may at times be traced to abdominal injury. Openings in the omentum may be due to injury or congenital causes.

Herniation through abnormal openings resulting from operation are discussed under "Postoperative Obstructions."



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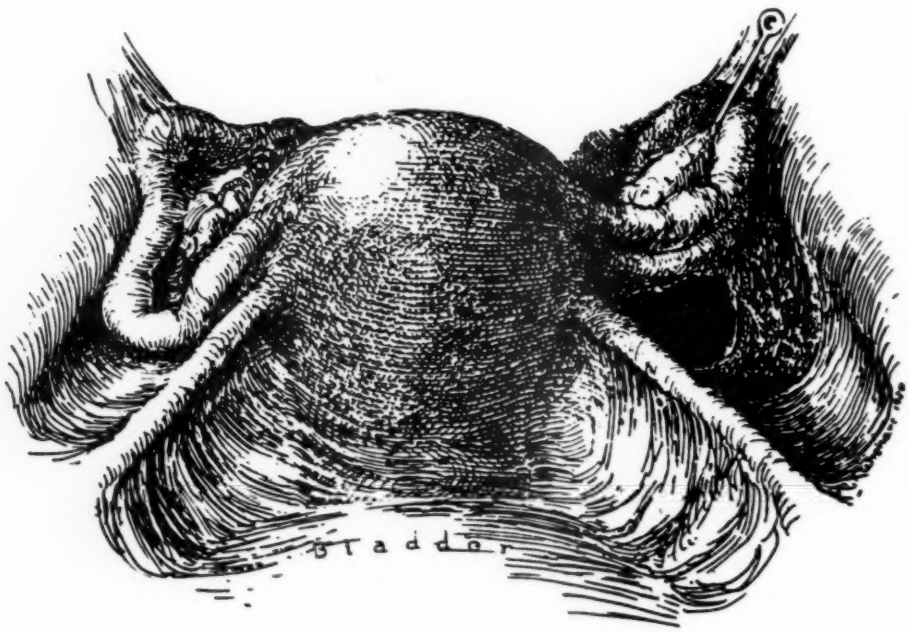

B

FIG. 32. Strangulation of loop of small intestine in opening of left broad ligament. (Janes[13])

A. Condition found at operation.

B. Opening in broad ligament after reduction of bowel.

In reference to the whole group of internal hernias, it may be said that herniation may occur without any symptoms of obstruction. Obstruction and strangulation usually follow,

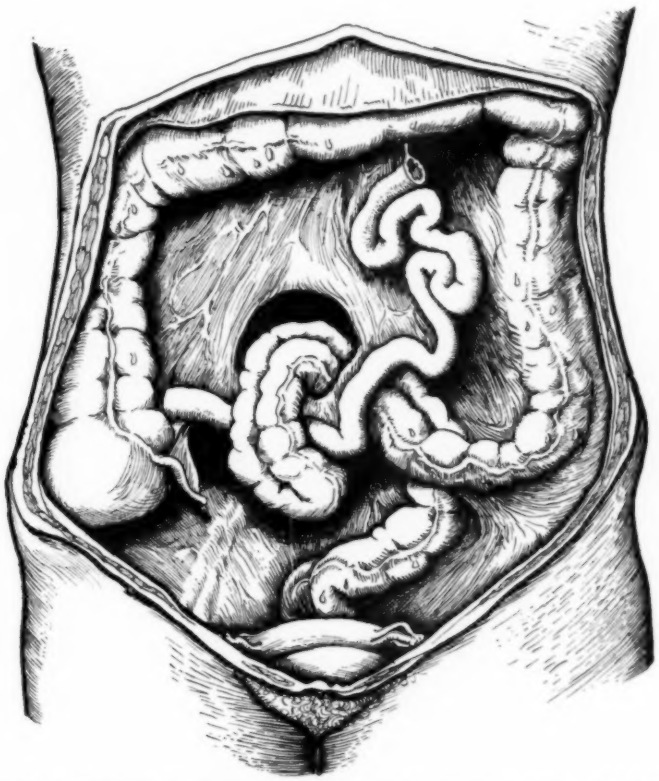

FIG. 33. Complicated type of internal hernia through mesentery, in which both sigmoid and ileum were involved. (Smith[15])

A. Sigmoid after it has passed once through defect in mesentery near ileocecal junction. Sigmoid was twisted through 180°.

however, once herniation has occurred.

CASE XII. *Strangulated internal hernia.*

No. 282,569, M. G. H. Male, aged thirty. Past history not remarkable. Three days before admission the patient was taken with severe lower abdominal cramp-like pain and vomiting. There had been no bowel movement for the past three days and enemas had been given without result.

On physical examination the patient appeared critically ill; pulse 120. There was board-like rigidity of the abdomen. White blood count, 25,000.

Immediate operation was carried out. When the peritoneal cavity was opened, turbid fluid with a foul odor escaped. It was found that the small

intestine had herniated through an opening in the lower portion of the mesentery. Approximately 2 feet of the intestine were gangrenous; this loop was resected and the ends brought out through the abdominal wound.

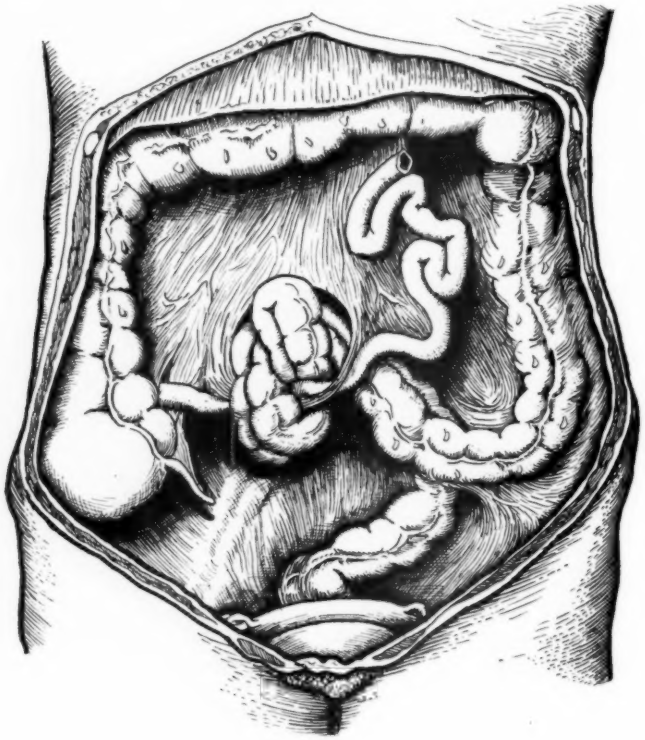

FIG. 33.

B. Sigmoid after it has passed through mesentery a second time, carrying with it adjacent ileum.

After a stormy convalescence the patient recovered. An end-to-end anastomosis was carried out at a later operation.

CONGENITAL ANOMALIES

As pointed out in Chapter II, congenital formations may be fundamentally responsible for a large and varied group of obstructions. In this section are considered only those occurring in infancy where a gross malformation is directly responsible for the obstruction. The group is relatively small and the mortality high.

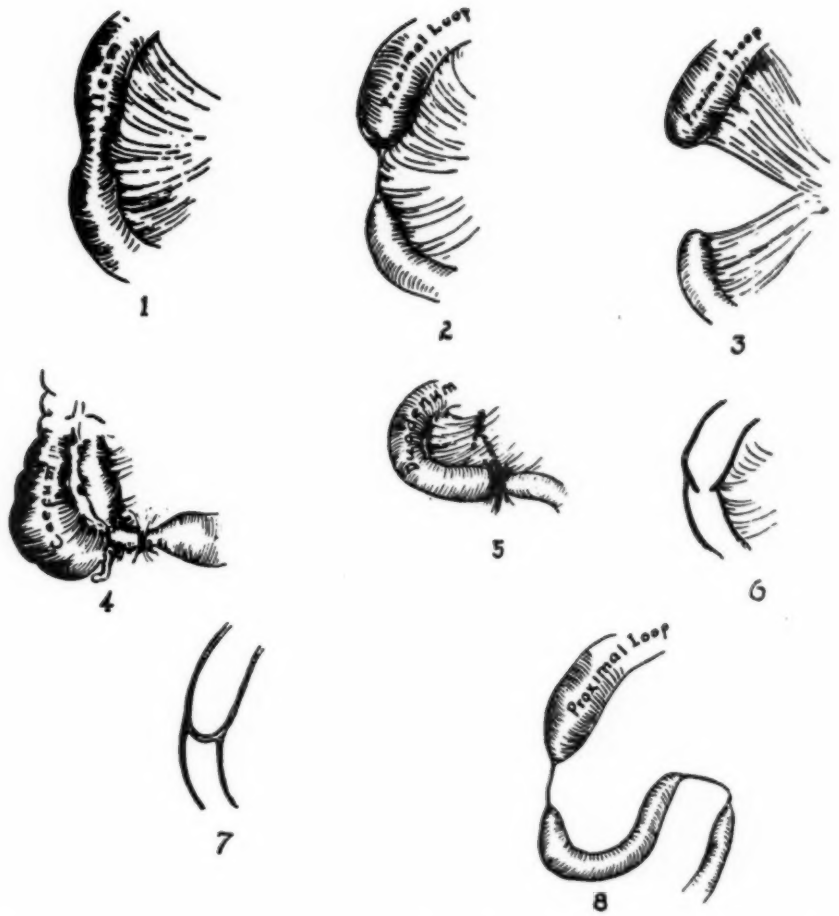

FIG. 34. Various types of congenital malformations described by Cole.[16] (1) Stenosis with partial obstruction. (2) Occlusion with blind loop. (3) Blind loop with gap in mesentery. (4) Obstruction by fibrous band (found usually in third part of duodenum or terminal ileum). (5) Obstruction at ligament of Treitz; occasionally an anomalous superior mesenteric artery is chief factor in producing obstruction. (6) Cross-section of intestine showing perforated diaphragm; this occurs usually in duodenum or terminal ileum. (7) Cross-section of imperforate diaphragm. (8) Multiple occlusion of ileum or jejunum; this constitutes about 15 per cent of atresias of intestine. Clinically, dilatation of proximal loop with collapse of distal loop is usually even more pronounced than shown in this illustration.

Congenital anomalies causing obstruction are of two types: the atresias;[16–20] and the congenital defects of rotation that are responsible for volvulus[21,22]. According to Davis and Poynter,[17] an atresia may occur at any point in the intestinal tract; they are encountered with especial frequency in the duodenum. (See Table VI.) In about 15 per cent of Davis' cases there were multiple atresias. The developmental defects responsible for volvulus were discussed in Chapter V.

Meckel's Diverticulum

Meckel's diverticulum as an etiological factor in intussusceptions has already been discussed (Chap. VI). The diverticulum may also cause obstruction in other ways. Chief among these is the strangulation of a loop of gut, the diverticulum acting as a band[23,24] (see Chap. III). This occurred in 101 instances in the series collected by Porter.[23] Rarely a long diverticulum having its distal end free may act as a noose and snare a loop of bowel. Occasionally a Meckel's diverticulum is responsible for a volvulus. In some cases the diverticulum may itself become twisted and in the twist involve the portion of bowel from which it originates.[25]

The clinical picture presented by these cases of obstruction from a Meckel's diverticulum is that of strangulation from any cause. These cases are, however, especially serious because the diverticulum, due to its poor blood supply, is likely to undergo early necrosis and perforation, with resulting peritonitis.

Gallstones and Other Foreign Bodies

Among the rarer types, obstruction from gallstones occupies a rather important place. Of the 335 cases of intestinal obstruction at the Massachusetts General Hospital in 1918–1927, a gallstone was responsible for the obstruction in 5 instances. Occasionally stones are found in the intestinal tract, which from their composition might be considered to be gallstones, but which are apparently formed in the intestinal

tract, from the constituents of bile, rather than in the gall bladder. Hellström[26] has collected 7 cases, including 2 of his own, in which stones consisting almost entirely of colic acid were found in the gut. These stones were evidently not formed in the gall bladder, but in the intestine, for the gall bladder was normal, and in some of the stones there was a nucleus of vegetable matter that could have come only from the alimentary canal. Phillips[27] suggests that all "gallstones" removed from the intestinal canal should be analyzed with this possibility in mind.

The large gallstones (not infrequently measuring 4 or 5 cm., or more, in diameter) that are capable of producing obstruction, gain entrance to the intestinal tract by ulceration between the gall bladder and the intestine. After a stone has entered the gut it may be increased in size by the deposition of phosphates or carbonates from the intestinal tract; or, mineral matter (such as magnesia) that has been taken as a medicine, may be deposited around a gallstone and increase its size.[28]

The gallstone may become impacted in the intestinal canal simply because of disproportion between the size of the stone and the diameter of the lumen. In certain cases the presence of the foreign body may incite a spasm in the intestinal musculature and this may be largely responsible for the onset of the acute obstruction.

The stone producing the obstruction may be found in the duodenum or upper jejunum; or, as more frequently happens, it may pass to the last 2 or 3 inches of the ileum or to the ileocecal valve before becoming impacted. In 32 cases in which the position of the stone was given, reported by Leichtenstern,[29] the location was as follows:

Duodenum and jejunum	10 cases
Middle ileum	5 cases
Lower part of the ileum	17 cases
	32

Rare cases have been reported in which the stone was located in the large intestine or cecum.

Changes in the bowel wall at the point where a stone becomes impacted may be slight; or, in certain cases, there may be ulceration or necrosis. The stone may at times produce a diverticulum.

Clinical Course. Obstruction by gallstones occurs much more frequently in the female than in the male: the 5 cases reported in the 1918–1927 Massachusetts General Hospital series all were in females; in Leichtenstern's[30] series of 41 cases there were 32 females and 9 males. The disease is usually one of old age, although it occasionally occurs in middle life. It is usually possible to elicit a history of attacks of cholelithiasis or cholecystitis in the past.

The disease may run an acute course from the beginning; but often it is subacute for a number of days or even weeks before becoming acute. The count of the white blood cells in the 2 cases of the Massachusetts General Hospital series where it was recorded was elevated (17,000, 24,000); the temperature is usually normal or only slightly elevated. The following are rather typical histories:

Case xiii. *Obstruction by gallstone.*

No. 285,537, M. G. H. Female, aged sixty-seven. Patient gave a history of six days' upper abdominal pain and continuous severe vomiting; there had been only one bowel movement during this period.

Physical examination showed marked distention of the abdomen; there was some generalized tenderness; no muscle spasm.

The patient was operated upon the day after admission. At operation a gallstone about 4 cm. in diameter impacted in the lower ileum was found to be responsible for the obstruction. The stone was removed and an ileostomy done just above this point. The distention was not relieved after the operation and there was no drainage from the tube. The patient died one day postoperative.

Case xiv. *Obstruction by gallstone.*

No. 248,412 M. G. H. Female, aged sixty-eight. Patient had had no serious illness and there had been no previous attacks of abdominal pain. On admission complained of generalized abdominal pain and vomiting of three days' duration; the pain had been more severe in the region of the

epigastrium, and had been cramp-like in character. During the three day period there had been no bowel movements, and enemas gave negative results.

Physical examination was essentially negative except for a rather markedly distended abdomen. On auscultation, peristalsis was active.

The patient was operated upon at once. At operation there was a large quantity of free fluid in the abdomen, somewhat turbid in appearance. On exploration a large gallstone was found in the lower ileum. This was removed. There was a large mass of dense adhesions in the region of the gall bladder and duodenum; the omentum was adherent to this area. These adhesions were not disturbed.

After a somewhat stormy convalescence the patient recovered.

Comment. It is interesting that although there was "a mass of adhesions" in the region of the gall bladder and evidently the stone had entered the small intestine by perforations between the gall bladder and an adjacent coil of intestine, no history was obtained suggesting previous attacks of gallstone colic.

CASE XV. *Obstruction by gallstone.*

No. 223,351, M. G. H. Female, aged forty-six. Patient gave a past history of two attacks of abdominal pain, ten years and one year ago respectively; she had never been jaundiced. The present illness began two weeks before admission; the patient had had constant severe pain, cramp-like in character, in the upper half of the abdomen during this period. Patient had vomited ten to twelve times daily during the two weeks, the vomitus being "fecal" the morning of admission. Enemas daily for the two weeks had produced some results.

Physical examination showed the right half of the abdomen to be very tender; there was no tenderness in the left half. There was a moderate degree of muscle spasm over the whole of the right upper quadrant, and slight spasm in the right lower quadrant. Temperature 97°F.; pulse 104; white blood count 17,000.

At operation numerous adhesions were encountered; certain of these were freed, but no definite point of obstruction was located. The patient's condition became critical and the operation was terminated. The patient died fourteen hours later.

The autopsy showed acute intestinal obstruction from an occluding gallstone in the ileum. There was necrosis of the gall-bladder wall and the wall of the duodenum, the ulceration connecting these two structures.

Comment. Apparently in this case the early symptoms were due to acute cholecystitis. This attack terminated with the discharge of a gallstone into the intestinal tract where it caused obstruction.

Various Other Foreign Bodies. Other contents of the intestinal tract may at times cause obstruction. Such obstructions are rather infrequent and have been caused by a miscellaneous lot of material. Accumulations of food[31] that have a high cellulose content may at times produce an obstruction. In 2 cases of the recent Massachusetts General Hospital series, indigestible vegetable matter had become impacted in the terminal ileum; in one instance this material was the husks of corn, in the second instance it was bran. Davis[32] has reported a similar case. Impacted vegetable matter occasionally produced obstruction in diabetic patients before the days of insulin, when enormous quantities of green vegetables formed the chief part of the diet. Leichtenstern[33] has described "sponge-like stones" that are formed chiefly of masses of indigestible vegetable fragments.

Hair-balls,[34,35] pieces of wood and other bizarre collections of material have been reported as causing obstruction. These cases are usually met with in the insane or feeble-minded.

Obstruction from enteroliths or "intestinal stones" occurs in rare instances. The stones may be composed of various inorganic salts[36] as, for example, calcium or magnesium phosphate, calcium carbonate, etc. The mineral matter composing the enteroliths may have been taken as a medicine over a long period of time[37]; and, as has already been pointed out, bile salts or pigments may enter into the formation of such stones.

A number of instances[38–40] have been reported where masses of Ascaris lumbricoides have produced acute intestinal obstruction. In the obstructions produced by these parasites there may be two elements: the mechanical blockage of the lumen, and a spastic contraction of the gut due to a toxin given off by the worms. Herrick and Emery[41] were able to demonstrate that extracts made from Ascaris produced an increased tone and rate of contraction of intestinal musculature. An article by Morton and Archer[40] deals with the general surgical aspects of Ascaris lumbricoides, and describes a technique for demonstrating their presence by *x*-ray.

Inspissated "sebaceous material" causing obstruction in the new born has been reported.[42] Bullowa and Brennan[43] report one case of obstruction by inspissated meconium.

FIG. 35.Tuberculous stricture of ileum. (Treves[44])

TABLE VI

CONGENITAL OCCLUSIONS: CASES OF ATRESIA

Position of Atresia	*Number of Cases*
Duodenum, above papilla	59
Duodenum, below papilla	75
Jejunum	60
Ileum and cecum	101
Colon	39
Multiple atresia	67

It will be noted that congenital occlusions are most frequent in the duodenum and in the region of the ileum and cecum. The atresias in this series were multiple in about 15 per cent of the cases. (Davis and Poynter.[17])

When various mechanical devices, such as buttons, have been used for making intestinal anastomoses, these devices themselves have occasionally produced obstruction.

Occasionally a relatively small foreign body may become impacted in a benign or malignant stricture such as is shown in Figure 35.

Bismuth and barium taken by mouth for the purpose of *x*-ray examination are capable of converting a subacute into an acute obstruction. The danger of administering such materials for diagnostic purposes where there is a possibility of obstruction is recognized; but occasionally the seriousness of the situation is not appreciated and their use has been followed by an acute obstruction. This is a very grave type of obstruction: it may not be realized early that an acute obstruction has been produced; and it may be difficult, or impossible, to get rid of the barium even after the intestine has been opened: if peristalsis has stopped by the time the operation is undertaken the barium lies in the intestine as an inert mass and it may be impossible to get rid of it even though an enterostomy is carried out. Case XVI is of this sort:

CASE XVI. *Obstruction due to bismuth administered for x-ray examination.*

No. 241,088, M. G. H. Female, aged thirty-nine. Fifteen years before the patient's present admission she was operated upon for acute appendicitis. About six months before entrance she had an attack of what was evidently subacute obstruction. Since that time she had been greatly troubled with obstinate constipation, for which she frequently used cathartics. At times she had attacks of abdominal pain and occasionally vomited. There had been considerable loss of weight.

For the past two months the vomiting and pain had greatly increased in amount. Constipation had been very severe. She had vomited at least once a day for the past month.

In the course of her study on the medical wards she was given barium by mouth for a gastrointestinal examination. The day following this the vomiting increased in amount; the pain was about what she had experienced in the past. On the following day both vomiting and pain were worse and she had considerable distention. The vomitus was very profuse, brownish in color, but was said not to be foul. No result was obtained from enemas.

She was operated upon under gas-oxygen anesthesia with the addition of a small amount of ether. The small intestine was greatly dilated and contained a large amount of bismuth. An enterostomy was carried out in

the lower ileum, but very little bismuth drained out through the catheter. The patient's condition did not warrant extensive exploration. Numerous adhesions were found and some were separated; but no definite point of obstruction was located. The patient died about five hours postoperative.

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THIS MONTH'S CONTRIBUTORS

AUSTER, LIONEL S., M.D., N. Y.
Adj. Surg. & Assoc. Path., Bronx Hosp.; Assist. Vis. Surg., N. Y. C. Cancer Inst. & Hosp.

BRENIZER, ADDISON G., M.D., F.A.C.S., CHARLOTTE, N. C.
Lect., Surg., Duke Univ. Med. School; Surg., Charlotte Sanat.

CAMPBELL, MEREDITH F., M.D., F.A.C.S., N. Y.
Assist. Att. Urol. Surg., Bellevue Hosp.; Staff, Child's Hosp.

CARABBA, VICTOR, M.D., N. Y.
Instr., Surg., N. Y. Univ. Bellevue Hosp. Med. Coll.; Assist. Vis. Surg., Bellevue Hosp.

CHAFFIN, RAFE C., M.D., F.A.C.S., Los Angeles.
Assist. Prof. Gynec., Coll. Med. Evangelists School of Med.

CUTLER, ELLIOTT C., M.D., D.S.M., F.A.C.S., Boston.
Moseley Prof. Surg., Harvard Med. School; Surg.-in-Chief, Peter Bent Brigham Hosp.

DERBRUCKE, MAURICE G., M.D., Bklyn., N. Y.
Att. Obstet., Coney Island Hosp.; Assist. Gynec., N. Y. Post-Graduate O.P.D.

EDWARDS, CHARLES REID, M.D., F.A.C.S., Baltimore.
Prof., Clin. Surg., Univ. Md. & Coll. of Phys. & Surg. School of Med.; Vis. Surg., Univ. Hosp. & Church Home & Infirm.

EWELL, GEORGE H., M.D., Madison, Wis.
Urol , Jackson Clin. & Methodist Hosp.

GILL, RICHARD DULANY, M.D., F.A.C.S., Wheeling, W. Va.
Instr. Urol., O.V.G. Hosp. Train. School for Nurses & Reynolds Mem. Hosp. Train. School for Nurses, Glendale; Urol., Wheeling Hosp. & Clin., Ohio Valley Gen. Hosp.; Cons. Urol., Reynolds Mem. Hosp., Glendale, & Barnesville Gen. Hosp., Barnesville.

GLASSER, S. THOMAS, M.D., N. Y.
Vist. Surg., Metropolitan Hosp. & Disp. & Flower Hosp.

GRIFFITH, JESSE B., M.D., Pittsburgh.
Demonstr., Orth., Univ. Pittsburgh Med. School; Orth. Staff, Passavant Hosp.

HELWIG, FERDINAND C., M.D., Kansas City, Mo.
Assoc. Prof. Patho, Univ. Kans. School of Med.; Path., St. Luke's & Children's Mercy Hosp.

HIPPS, HERBERT E., M.D., Marlin, Tex.
Orth. Surg., Torbett Sanat. & Clin.

JUNKIN, H. D., M.D., Paris, Ill.
Chief Surg., Paris Hosp.

KEMP, WILLIAM N., M.D., C.M., Vancouver, Can.
Anes., Vancouver Gen. Hosp.

LEWIS, SILAS A., M.D., F.A.C.S., Hollywood.
Surg., Hollywood & Cedars of Lebanon Hosp.

MCIVER, MONROE A., M.D., F.A.C.S., Cooperstown, N. Y.
Surg.-in-Chief, Mary Imogene Bassett Hosp.

MAHORNER, HOWARD R., M.D., M.S. (SURG.), New Orleans.
Instr. Surg., Tulane Medical School; Assist. Vis. Surg., Charity Hosp.; Staff: Touro Infirm.; Contributor: "Thrombo-Angiitis Obliterans," Phila., 1928.

MANN, LEWIS T., M.D., N. Y.
Assist. Surg. and Chief, Urol. Clin., Mt. Sinai Hosp.; Adj. Surg., Beth Israel Hosp.

MARBURY, WILLIAM B., M.D., F.A.C.S., Washington, D. C.
Assoc. Prof. Surg., Geo. Washington Univ. Med. School; Assoc., Surg., Emergency and Children's Hosp.

NERB, LOUIS, PH.D., Bklyn., N. Y.
Bacteriol., Brooklyn Hosp.; Head, Dept. of Bacteriol., Pratt Inst.

NEWBURGER, BERNHARD, M.D., F.A.C.S., Cincinnati, O.

RATHBUN, N. P., M.D., F.A.C.S., Bklyn., N. Y.
Chief, Dept. of Urol., Brooklyn Hosp.; Cons. Urol., Lutheran & Harbor Hosp.

RAZUMOVSKY, V. I., M.D., Essentuky, Russia.
Prof. Surg., Kazan Univ.

ROBERTS, CARL GLENNIS, M.D., Chicago.
Att. Surg., Sr. Staff, Provident Hosp.; Vis. Staff, St. Elizabeth Hosp.

RUSH, H. LOWRY, M.D., F.A.C.S., Meridian, Miss.
Surg., Rush Infirm. & East Miss. Insane Hosp.

RUSH, LESLIE V., M.D., Meridian, Miss.
Surg., Rush Infirm. & East Miss. Insane Hosp.

THOMS, HERBERT, M.D., F.A.C.S., New Haven.
Assoc. Prof. Obstet. & Gynec., Yale Univ. School of Med.; Author: "Chapters in American Obstetrics," Springfield, Ill., 1933.

TRUSLOW, WALTER, M.D., F.A.C.S., Bklyn., N. Y.
Cons. Orth. Surg., Brooklyn, St. John's Hosp. & N. Y. Health Dept.

VIDGOFF, I. JACK, M.D., Los Angeles.
Instr. Surg., Univ. S. Calif. Med. School; Jr.

Surg., Los Angeles Co. Gen. Hosp., Surg. Staff, Unit 1.

Wallace, Jess Thornton, m.d., N. Y.
Assist. Gynec. & Obstet., Brooklyn Hosp.; Chief Gynec. & Obstet. Clin., Brooklyn Hosp. Disp.

Wilson, Clyde L., m.d., Jersey City.
Assist. Res., Surg., Med. Cent.

Wolepor, Ben, m.d., Montreal, Can.
Outdoor Dept., Gen. Med., Royal Victoria Hosp.

Wright, John M., Indianapolis, Ind.

Wright, Robert Broy, m.d., Baltimore.
Assist. Prof. Pathol., Univ. of Md. School of Med.

Zollinger, Robert, m.d., Boston.
Instr. Surg., Harvard Med. School; Res. Surg., Peter Bent Brigham Hosp.

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